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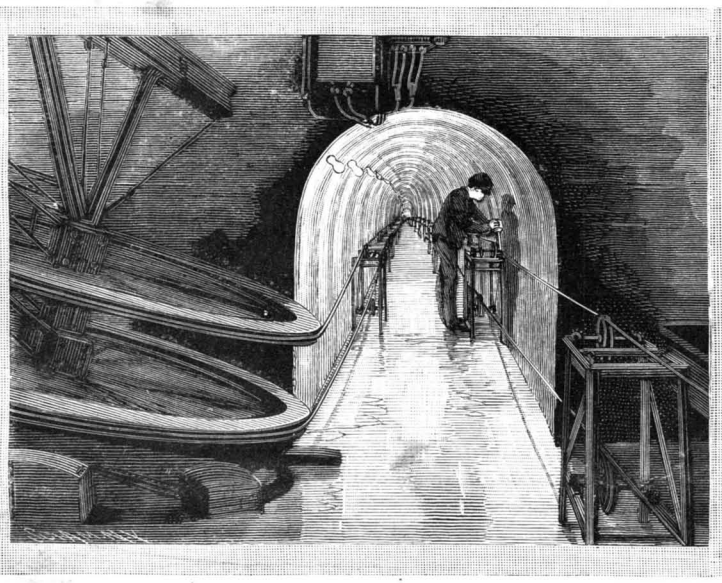

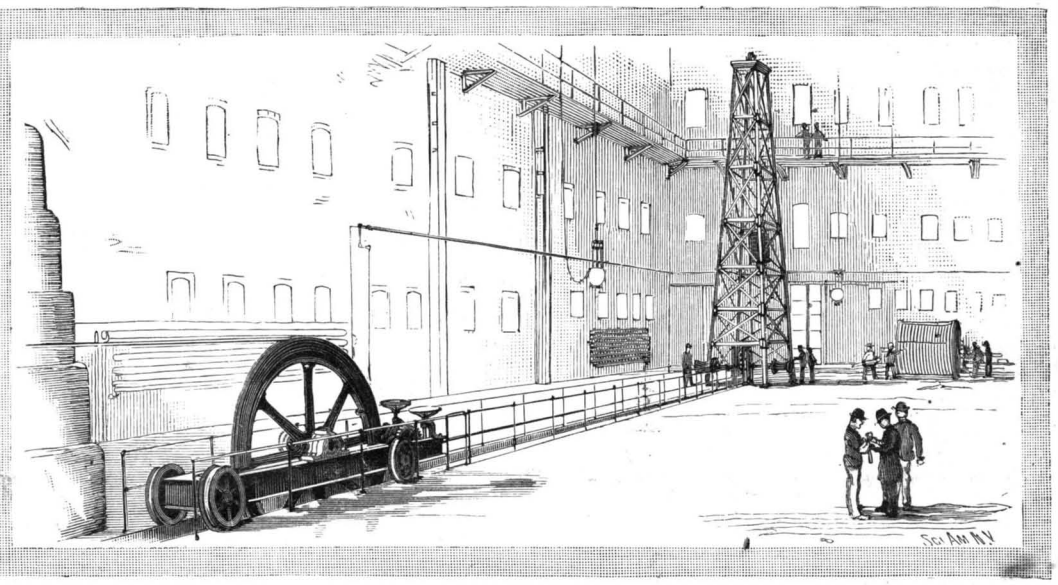

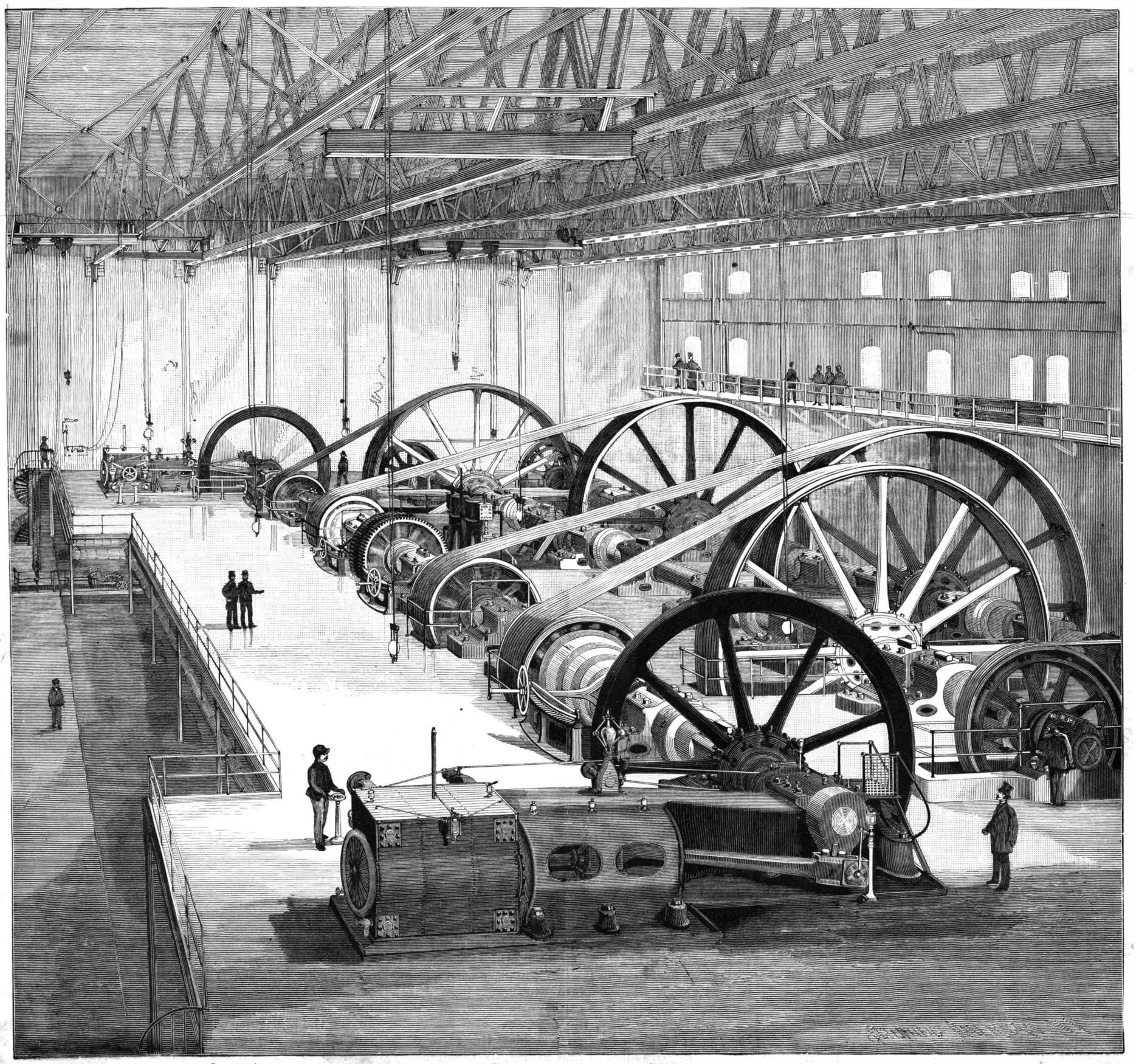

THE BROADWAY CABLE RAILWAY—THE POWER STATION AT 51st STREET.—[See page 249.]

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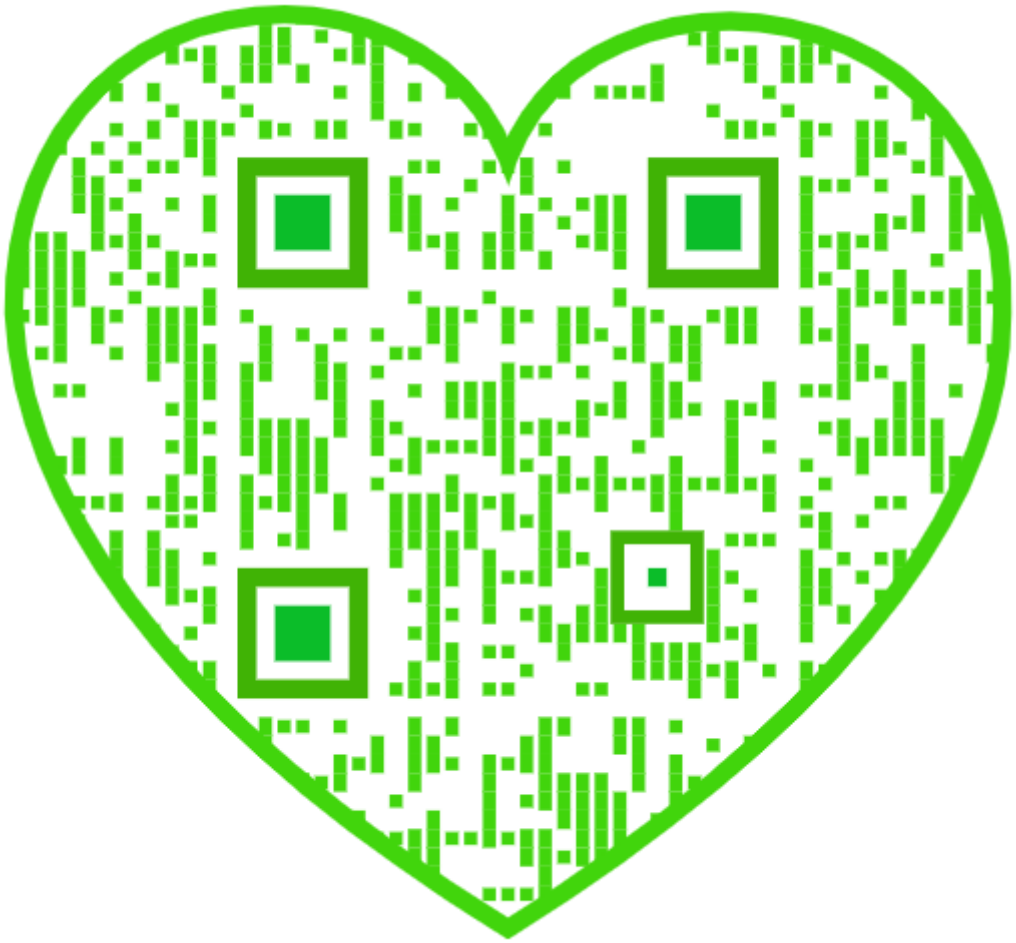

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NEW YORK, SATURDAY, APRIL 22, 1893.

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PROGRESS OF AMERICAN DAILY NEWSPAPERS.

The daily *Inter-Ocean*, of Chicago, recently celebrated the 21st anniversary of its life by the issue of a sixty page number. All this for two cents. As each page contained approximately eight thousand words, probably it is not far out of the way to estimate that this one number of the paper presented not far from four hundred thousand words, which is nearly equal to the typographical contents of two ordinary book volumes each of five hundred pages. These sixty pages, besides telegraphic news and correspondence from all parts of the world, local matters and advertisements, embraced a very large amount of useful information upon a great variety of topics, including education, science, mechanics, the great Fair, and hundreds of other subjects of interest to the general reader.

The *Inter-Ocean* ranks among the most widely circulated, influential, and profitable newspapers in the world. It is a worthy example of that vigor and spirit of enterprise which may be said specially to characterize the American daily newspaper press.

RARE CHANCE FOR ARCHITECTS.

The municipal authorities of New York City have determined to erect a new City Hall, and have issued advertisements calling for designs. Premiums to the amount of ten thousand dollars are offered, to be divided in equal parts, or two thousand dollars each, to the five architects whose designs come next to that which shall be finally selected. The author of the accepted design will be appointed architect, and his reward will be large, as he is to receive five per cent on the first million dollars of cost, four per cent on the second million, and three per cent on all beyond two millions. The politicians who rule New York City have known in the past how to plunder the people out of extravagant sums for buildings, and there is no telling how much they will make the cost of the new edifice; but, doubtless, the expense will be made to rise to several millions. This would form a handsome plum for the successful architect, were it not that, according to all precedents, he will be obliged to share his commissions with the controlling political managers, and keep his mouth shut tight.

THE COMING NAVAL REVIEW AT NEW YORK.

The great naval display in American waters, in celebration of the 400th anniversary of the landing of Columbus and preliminary to the opening of the World's Columbian Exposition at Chicago, will be the pageant next in order. Important war ships from Spain, with the three imitated ships of Columbus, are to assemble in Hampton Roads; also war vessels from Great Britain, France, Germany, Russia, Italy, Brazil, Argentina and other nations. The American navy is well represented. The great fleet is expected to sail from Hampton Roads on the 24th inst. and to reach the Bay of New York on the 25th.

On the morning of the 26th the ships will steam up the bay and enter the Hudson River, making anchorage in two lines directly opposite the city, extending from 30th Street on the south to 90th Street on the north, a distance of three miles. This will cover the major portion of the beautiful Riverside Park, which adorns the edge of the river and reaches from 72d Street to 125th Street. On the New Jersey or west side of the river are the high cliffs known as the Palisades. Fine views of the maneuvers will be here obtainable.

On the morning of the 26th an interesting ceremony will also take place pertaining to the inauguration of a statue to John Ericsson, which is to be placed in the beautiful Battery Park, at the extreme southern point of the city, where the waters of the Hudson and East rivers meet and flow southerly into the Bay of New York.

Ericsson was, in a certain sense, the father of ironclad war ships. In connection with the statue inauguration there is to be a grand parade on Broadway.

On the day following, April 27, a grand naval review will take place. The President of the United States and many distinguished members of the government, foreign ambassadors, and prominent visitors will take part in the affair. Among them will be Don Chrisobal Colon de la Cerda, from Spain, who is a lineal descendant of the Great Admiral. Elsewhere we give his portrait.

The President and party, amid the thundering of great guns, will embark on the war steamer Dolphin, and move up the river, between the two lines of war ships. Each vessel, as the Dolphin passes, will fire a salute of twenty-one guns. After passing through the great fleet, the Dolphin will come to anchor, and the President will hold a reception for the commanders of the various vessels, after which, the President will disembark; and at this moment each of the great ships will deliver another thundering salute of twenty-one guns. The festivities of the day will close with a grand ball at the Madison Square Gardens, where fifteen thousand people may be easily entertained.

On the following day, the 28th, Broadway will be the scene of further festivities, taking the form of a grand parade of soldiers and sailors, to which many of the war ships will contribute quotas of men. The line of march is to be from the beautiful Italian statue of Columbus, at 59th Street, the entrance to Central Park, down Broadway to the City Hall, a distance of five miles, where the governor, the mayor and the civic authorities will receive and entertain the honored guests.

This will be the greatest naval demonstration ever witnessed in the new world and will form a fitting prelude to the opening ceremonies of the World's Columbian Exposition, which take place at Chicago on May 1.

CANNONADES FOR RAIN MAKING.

Incidentally connected with the great naval review which takes place before the city of New York on the 27th, it will be interesting to notice what, if any, meteorological effects are produced by the great cannonading which is to take place. Some forty ships, nearly all carrying great guns, are to deliver double salutes almost simultaneously; and if there is any virtue in concussion as a means of artificially producing rain, then New Yorkers may look for a deluge soon after the last gun is fired. April is the month for natural showers in this vicinity. But should it be a clear day, with no signs of rain until the opening of the cannonade, and rain should then fall, it would be a decisive point in favor of the rain makers.

Curious Examples of Fires.

The *Railway Review* has collected some curious examples of the way in which fires may be set. In one instance, where some waste, which had been used with mineral oil, had been thrown into a safe place, an insect crawled through it, and then, carrying some pieces of the oily fiber sticking to his body, made his way to a gas jet. The cotton fibers which adhered to him caught fire, and he dropped, blazing to the floor, setting the building on fire. In another case, a quantity of waste was said to have been ignited by the friction of a belt running close to it. This, however, may be considered doubtful. The friction of a belt against soft cotton is by no means of a nature to produce great heat, and a much more rational explanation is to be found in the supposition that an electric spark passed from the belt to some conducting substance through the cotton, which it ignited on its way, as sparks of frictional electricity can easily do. In fact, the electrical effects accompanying the running of large belts are quite important, and it is probable that more than one fire has been due to them. Sparks can be taken by the finger from almost any large belt in motion, and we have known a case where an ingenious engineer, by fixing a metal comb near the belt, succeeded in drawing off enough high tension electricity to enable him to light the gas jets in and about the engine room without matches by simply touching them, after turning on the gas, with a wire connected with the comb.

In two cases destructive fires have been caused by water. In one of these a flood caused the water to rise high enough in a factory to reach a pile of iron filings. The filings, on contact with the water, oxidized so rapidly that they became intensely heated, and then set fire to the neighboring woodwork and the building was destroyed. In the other case, the water from the engines, during a fire, found its way into a shed containing quicklime, and the heat generated by the slaking of the lime set fire to the shed, and this to other buildings. Quicklime fires, however, are not uncommon. Many vessels carrying quicklime have probably been burned by the admission of water to the lime through a trifling leak, and no architect or builder needs to be told how intense the heat of slaking lime may be. Glass globes, which act as lenses, often set fires, and it has recently been claimed, on high authority, that the convex glasses used in sidewalk lights are dangerous, and should be abandoned in favor of lights with flat tops. As the convex glasses receive and transmit much more light than the flat ones, particularly in muddy weather, it seems hard to be obliged to give them up, and perhaps a lens might be made convex on the outside and concave on the inside, the concavity being equal to or greater than the convexity, so that rays of sunlight would either pass through unchanged in direction or would be dispersed instead of being concentrated, so as to unite the advantages of the convex form with complete security.

Zinc in Wool Dyeing.

The evil influences of copper vessels in wool dyeing can be avoided by placing in the dye bath a number of strips of zinc just touching the copper vessel. The two metals form an electrical couple, the copper is prevented from passing into solution, while the zinc which takes its place exerts little or no influence on the tint which is being dyed. The zinc gradually corrodes, but is easily replaced. One other advantage is that the copper kettle, not being acted upon by the acid liquors, lasts longer, a point of no little importance considering the high price of copper. This little improvement is likely to prove of great advantage to wool dyers.

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The question of union or non-union labor has been a very sensitive one with the World's Columbian Exposition from the time of the inception of work. When the decision was finally made that the Exposition should be held in Chicago an agreement was entered into between the Building Trades Council and the Exposition management to the effect that the Exposition would acknowledge an eight-hour day, minimum rate of wages, and the arbitration of all differences. The trades council endeavored to induce the Exposition to recognize only union labor, but failed in this, and matters were left with the distinct understanding that the Exposition management should be at liberty to employ competent labor of any kind, regardless of its union affiliations.

Since the first of April there have been several strikes and threats of striking on the part of several organizations represented in the building operations at the Exposition. Considerable time has been lost by these strikes, but the Exposition management has lived up to its agreement at all times, and whenever there has been any question of doubt the workmen have been given the benefit of it. In all cases where a demand for increased wages has been made and there has been any excuse within reason for making the increase, it has been given. When the painters struck they demanded forty cents an hour, and rather than have any further differences, and in order to give the men every inducement to continue work without any break, their wages were made forty-five cents, or five cents an hour more than they asked for. At the same time that the painters asked for more pay, the carpenters presented similar demands, and coupled with their demands the request that only union labor be employed. The contractors who were working on contracts taken from the Exposition management made satisfactory arrangements with the trades council. The Exposition management, however, had no reason to make any different arrangement from the one it had with the trades council, although it acceded to the demand for increased wages. The president of the Carpenters' Union, regarding the situation as most opportune for drawing into the union all non-union men employed in the Exposition grounds, and desiring that the union should be formally recognized by the Exposition management, presented a demand that all non-union men be discharged. The Exposition officials declined to accede to this demand, and the carpenters struck. This strike did not seriously cripple the Exposition, because nearly every one of the strikers took his tools and went to another part of the grounds and hired himself out to some contractor. When making the demand that all non-union men be discharged, the union did not offer to supply the places of the non-union men with union men, although it was known that the Exposition was engaging all the carpenters that it could find. Had it not been for walking delegates, it is probable that the trouble would have ended here, and the places of the striking carpenters would have been filled from outside sources. During the latter part of one week walking delegates stirred up discontent among union men of all kinds within the Exposition grounds, claiming that a great principle was at stake because the Exposition would not acknowledge the unions and discharge all non-union men. Saturday night, April 8, after a lengthy meeting, the trades council sent formal notification to the World's Fair Council of Administration informing them that if the demands of the union were not acceded to by 8 o'clock Monday morning and non-union men discharged, all union men employed in the Exposition grounds would strike. Monday morning, as the thousands of workmen went to the Exposition grounds prepared to continue in their work, they were met at the gates by walking delegates and other union representatives, who persuaded them from going to work, and some six or seven thousand men either did not go to work at all or quit work during the day.

The Council of Administration, serious as the situation was, declined to discharge the non-union men, and went on with the work with what men remained faithful and what more it could employ.

During the afternoon a conference was held between representatives of the trades council and the Council of Administration and an agreement drawn up and signed, by which the labor organizations agreed to see the work of completing the Exposition carried out without further striking. The point at issue, that of discharging non-union men, was left as it had been before, not figuring in the agreement by which the strike was declared off.

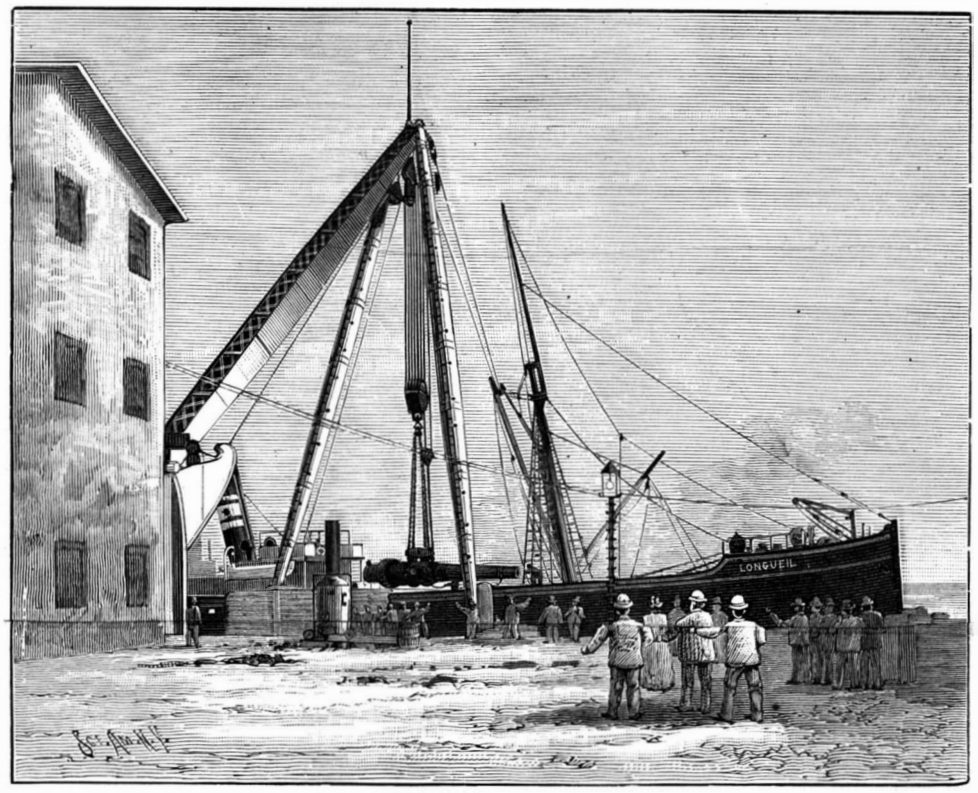
It was fortunate for the Exposition that the strike did not last longer, yet a large amount of work was lost, as the services of 7,000 men were lost for one day. Among the men that struck were the carpenters, painters, iron workers of several kinds, hod carriers, cornice workers, steam fitters, gas fitters, electrical workers, tile layers, mosaic workers, lathers, fresco painters, marble cutters, gravel roofers and several other unions. Most of the men were back at work Tuesday morning, and by noon very few places were vacant.

Work has progressed in the Forestry building in installing exhibits so as to give some idea of how attractive the display in this building will be. New South Wales, Australia, is making an extensive exhibit, showing sections of tree trunks finished in such a manner as to show effectively the grain and color of the wood. Some of these pieces of wood are enormous, being three feet or more wide. Near by Brazil is arranging a fine exhibit. The space is surrounded with trees which are about twenty-five feet high, and the tips of the branches are cut off in such a manner as to give them symmetry. This exhibit will be very rustic in effect. The Ohio exhibit adjoins that of Brazil, and is about completed. It is arranged for a complete display of samples of wood in a neat pavilion, the pillars of which are tree trunks about twelve inches in diameter, with the bark intact. This exhibit promises to be a very attractive one.

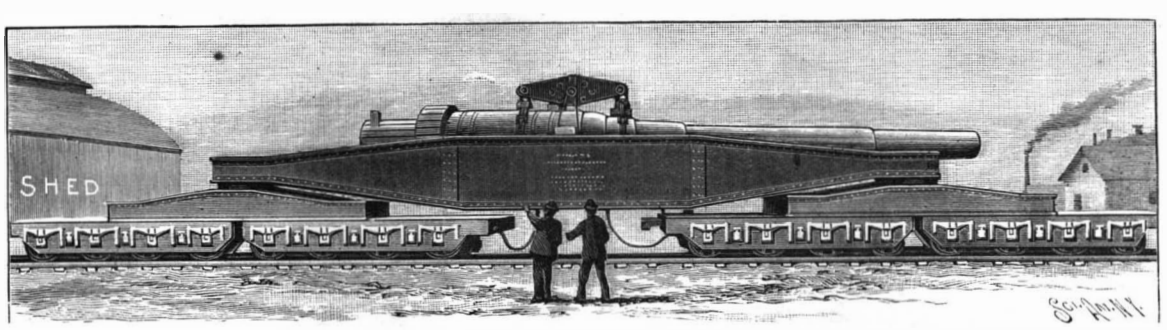
The painting machines have just completed their work in the Leather and Shoe Trades building, giving the interior a very attractive effect. Meantime, while the painting has been going on, exhibitors have been placing pavilions and show cases. The offices in this building will be an attractive feature that visitors should not neglect to see. Leather will be used very extensively in decorating and ornamenting them; the furniture is to be leather covered, and in every way possible leather will be used to show its value for decorative and ornamental purposes.

The Krupp building is nearing completion. The installing of exhibits has been going on at the same time that the workmen have been completing the structure, and this work is nearly completed, except the placing of the 250,000 pound cannon.

Workmen have nearly completed berths in which the electric launches are to be placed when charging their storage batteries. This storage station is situated under the platform surrounding the southeastern corner of the Agricultural building in what is called the South Pond. The electric energy for use in storing these batteries will be supplied by Edison generators, which form part of the electrical equipment of the power plant in the Palace of Mechanic Arts. The General Electric Company has immediate charge of this work of charging the launches.



THE WORLD'S COLUMBIAN EXPOSITION—LIFTING THE 120-TON KRUPP GUN FROM THE SHIP.



THE 120-TON KRUPP GUN AS PLACED ON THE SPECIAL CAR.—[See page 244.]

On the pier at which the steamboats will land their passengers will be a movable sidewalk for the purpose of carrying passengers to the head of the pier, landing them near the Casino and Peristyle. This sidewalk is 2,500 feet long and is completed except in a few minor parts. The substructure is raised about three feet above the level of the pier, and there is a loop at each end of the road for the continuous movement of the cars. Much of the rolling stock is on hand ready to be set in operation as soon as power is provided. There will be a small charge for riding on this novelty.

South of the Agricultural building is a large display of windmills, and what will add interest to this display will be the fact that one of the mills is a model of a famous Dutch windmill erected at Amsterdam, Holland, in 1806. Near by there will be eighteen windmills of the modern American type, varying in height from fifty feet or so to one hundred and thirty. Nearly all of the manufacturers of these mills will be represented. One of the largest mills will be one hundred and twenty feet high, and will have four small mills raised a little distance above the building at the base of the structure. In this building will be a full display of the machinery used in connection with windmills.

The effort to reduce the number of visitors at the Exposition grounds, by increasing the admission fee from 25 cents to 50 cents, seems to have had the opposite effect from what it was intended to have. With the beginning of spring people flock to the grounds by thousands, especially on Sundays. The first Sunday of April it was estimated there were at least 15,000 people in the grounds, while the Sunday following there were about 30,000. This attendance, at fifty cents a head, gave the Exposition a snug amount of gate receipts. On week days the crowd proved to be a great inconvenience, and, in order to prevent any interference with rushing the work of installing exhibits, visitors have been prohibited from admission to the buildings, and all passes granting such admission that have been issued, have been called in. This action will materially aid the Exposition, as passes were at one time given with much freedom, and the more important buildings were continually crowded with sight-seers.

A severe wind storm on Friday, April 7, caused considerable damage in and near the Exposition grounds. Two hotels that had been growing at a mushroom rate succumbed, and were completely demolished. Another building, outside the grounds, which was designed for a cyclorama, was also completely demolished. The most damage done by this storm inside the Exposition grounds was to the Marine Cafe, or French restaurant, as it is usually called. This was an attractive structure, which was being pushed ahead with much rapidity. The wind twisted it all out of shape, so that the building will require largely rebuilding. Accompanying this storm was quite a fall of rain, the first rainfall

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since the one when so much damage was done, two weeks before that. This rain was opportune, as it gave the Exposition management a chance to test the roofs, which had leaked badly. Those roofs that had been completed were found to be water-tight. In a few isolated instances more or less damage was caused by this rain, but these were in cases where the work of repairing the roofs had not been completed.

Much embarrassment has been caused the transportation department of the Exposition because exhibitors, in shipping their exhibits, have been negligent in marking the cases, stating where each one belonged. In order to prevent such embarrassment, the Exposition sent out, months ago, instructions as to how exhibits should be sent, with blanks to be attached to each package of exhibits. In instances where these instructions have been followed, exhibits are at once transferred from the cars and placed in the building and on the location, or as near to it as possible, where they belong. So many exhibits have come unmarked, and there has been so much negligence in this respect, that whole carloads of exhibits are delayed. As a consequence, there is a congestive condition of affairs in the transportation department. Were it not for these cargoes that cannot well be discharged, the tracks for handling exhibits would be nearly freed from cars each day. With from 200 to 300 cars of exhibits arriving every twenty-four hours, delays like these seriously hinder and lessen the likelihood of the Exposition opening in good shape on May 1.

Manitoba was not able to secure as much space as it wished from the allotment made to the Canadian government, and consequently has constructed a building of its own just outside the Exposition grounds. This building is now completed and is being fitted up with the exhibits of this province, and includes a large variety of displays, such as agricultural products, woods, polished and unpolished, fauna, educational exhibits, and a large variety of specimens of the handiwork of the Northwest Indians.

A model post office has been established by the Post Office Department in the southwest corner of the Government building. This post office is designed not only to be an exhibit of what a model post office should be, but it is also to serve as the postal substation for the Exposition grounds.

The annual meeting of the stockholders of the Exposition Company was held last week, and the old board was re-elected with a few minor changes. This insures the re-election of the more important of the old officers. What little opposition there was to the re-election of the old board came from two or three men who sought to become members of the board themselves for whatever honor there might be in it, rather than because of any inefficiency of the old board.

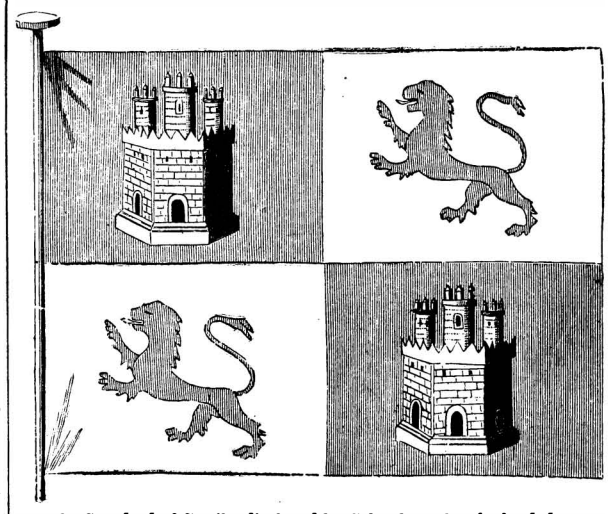
The deceased artists of America have been remembered, their names being given on the ceiling border in the Art Gallery. Among the names are the following: Fuller, Wylie, Brown, Kensett, Gifford, Audubon, Malbone, Pratt, West, Mount, Hunt, Lentz, Mignot, Hicks, Quartley, Jouett, Allston, Smibert, Copley, Lambden, Baker, Rossiter, Gray, Bellows, Jarvis, Waldo, Pine, Peale, Freeman, and Weir.

The holders of the concession for the Esquimaux village have a serious embarrassment on hand in the fact that the Esquimaux are not inclined to wear their fur clothing during the hot spring days, preferring in their place suits of blue jeans. As this is not a typical Esquimaux costume it detracts somewhat from the interest in the concession. The matter has been taken into the courts and the Esquimaux have won their case.

A MAMMOTH tusk was recently found in a mine at Schoningen, Brunswick, which, although broken off at the point, measures twelve feet in length and two feet in circumference, and weighs 224 pounds.

THE KRUPP EXHIBITS FOR THE COLUMBIAN EXPOSITION.

The steamship Longueil, which arrived at Baltimore March 18, brought the principal part of the contribution of the great German gun factory at Essen to the Columbian Exposition. By far the most noticeable portion of this exhibit is a great 120 ton gun, although the display includes several smaller guns and other war material, as well as some heavy steel productions for railway use. In last week's SCIENTIFIC AMERICAN was a picture, from a photograph, showing the guns as



The Standard of Castile, displayed by Columbus when he landed on Guanahaui, or Watling Island.

they arrived in the ship's hold, and in the accompanying illustration the large gun is shown suspended from the big hydraulic hoisting shears as it is being moved from the ship to the railway car. The shears are the largest and most powerful in the country. They are designed to lift 150 tons, have an overhang of 57 feet, and are 120 feet high. The gun is the largest piece of freight ever handled by any railroad, and was conveyed to Chicago by the Pennsylvania Railroad, on a car specially built for the purpose at their Altoona shops, from drawings furnished by Mr. Fried. Krupp, the car being similar to one built for the transport of the gun over German railways.

The car has a capacity of 285,000 pounds and is built entirely of boiler steel, the center plates and center bearings being steel castings. It consists of a major bridge, two minor bridges and four eight-wheel cars. The gun rests in the major bridge on two supports, designed to closely fit its perimeter. In addition to these two supports, to avoid any vibration while in transport, the muzzle is secured by wedge-shaped oak blocks set in cast iron shoes and drawn up to the muzzle by means of right and left hand screws. The major bridge is 50 feet from center to center of supports, and rests directly on the side bearings, while, on the other hand, the minor bridges are supported by their respective center plates.

The cars have been designed so as to combine strength with flexibility, and are equipped with Janney couplers and draughtrigging specially constructed for strength. The journals are 4½ by 9 inches; 37½ inch wheels, with wrought iron centers and steel tires are used. Each car has a 14 inch Westinghouse air brake cylinder, with brake on all wheels, and National hollow brake beams with Christie brake heads and shoes.

The load on cars is thoroughly equalized by 32 elliptic springs of 36 inch span, each spring having 18 leaves 3½ inches wide and ⅜ inch thick.

The extreme length of the car is 90 feet 9 inches; extreme width, 9 feet 10 inches; extreme height to top of bridge, 9 feet 9¾ inches.

For the foregoing particulars of construction of this great gun car we are indebted to Mr. Theo. N. Ely, chief of motive power of the Pennsylvania Railroad.

CRISTOBAL COLON DE LA CERDA, DUKE OF VERAGUA, MARQUIS OF JAMAICA.

Among the distinguished personages from foreign lands who are visitors to the World's Columbian Exposition is a direct descendant of the great admiral, the Duke of Veragua. For a pedigree and titles and the accompanying portrait we are indebted to *La Ilustracion Espanola*.

The present Duke of Veragua and Marquis of Jamaica, His Exc. Don Cristóbal Colón de la Cerda, is the direct descendant of the celebrated discoverer of the new world. He is the possessor of the titles "honorable and commemorative, of *Admiral of the Oceanic Sea and Governor in Chief of the Indies*, with the right to use the corresponding uniforms.". We give his portrait. The Duke of Veragua was born in Madrid in 1837. He took the course of jurisprudence in the Universidad Central, receiving the title of advocate; he did not figure in politics until after the revolution of 1868, when he fraternized with the liberal group, that defended the alliance of the democracy with the representative monarchy. He was elected a deputy to the Cortes by the district of Arévalo in the legislatures of 1871 and 1873, and in the following year he was a member of the Municipal Board of Madrid. When the legitimate monarchy was restored, he represented a district of Puerto Rico in the Congress, and he adhered to the liberal party.

A senator by his own right since the year 1876, he was Vice-President of the Alta Camara (Upper House) in 1890, when he was made Minister of the Interior in the cabinet over which Sagasta then presided.

He was President of the Congress of Americans that met in Madrid in 1881, President of the Superior Court of Agriculture, Royal Delegate of the "Instituto Agricola" of Alfonso XII., and Vice-President of the Board of Administration of the *Monte de Piedad* (a money-lending establishment under government control) and the Savings Banks of Madrid, and on July 21, 1887, he was decorated with the Great Cross of Charles III., possessing the diploma of Gentleman in Waiting, Grandee of Spain, since July 24, 1882.

The government of H. M. the Queen Regent, offering honorable testimony of consideration to the descendant of the illustrious admiral, appointed the Duke of Veragua President of the Central

(*Continued on page 247.*)

CRISTOBAL COLON DE LA CERDA—LINEAL DESCENDANT OF COLUMBUS.

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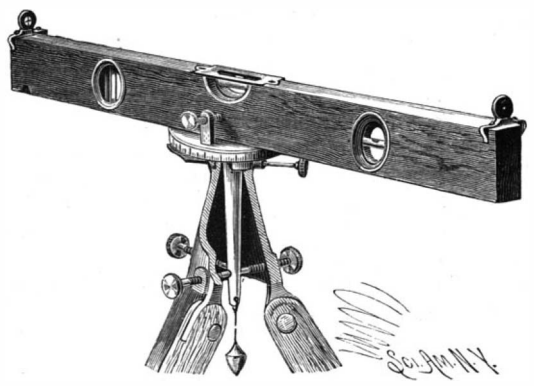
AN IMPROVED LEVELING INSTRUMENT.

The leveling instrument shown in the picture, which has been patented by Mr. Bela G. Merrill, of Oak Park, Ill., is more especially designed for the use of builders, carpenters, masons, and other mechanics, to facilitate the leveling and squaring of walls and other parts of buildings, and insure greater accuracy in such work. It has a hollow conical stand, from the bottom of which project lugs, to which are pivoted the legs, though the latter may be dispensed with and the stand set with its lugs immediately on the wall or sill of a building. The upper end of the stand has a cylindrical bearing engaged by the hub of a pointer, held in place by a set screw, the outer end of the pointer having a knife edge to indicate on a graduation on the outer surface of a circular flange on the

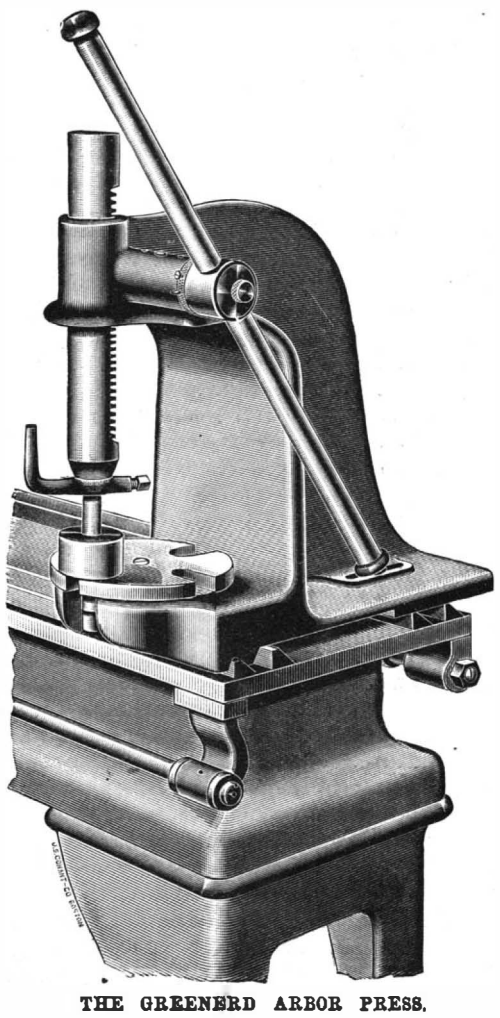


MERRILL'S LEVELING APPARATUS.

transit. The latter has centrally on its under side a tapering stem, and sets on lugs projecting inward from the top of the hollow stand, a cord and plumb being suspended from the lower end of the stem, and the stem being held in adjusted position by set screws. On the top of the transit are lugs, between which the level is held by a set screw, to prevent its slipping, the bottom of the level resting on the top edge of the flange. The sights are held in place by a cross bar, having at its ends downwardly curved springs engaging the sides of the level. The graduation on the peripheral surface of the transit indicates degrees of a circle, to facilitate the obtaining of angles by means of the adjustably held index pointer, the vertical movement of the latter also permitting of the tilting of the transit to obtain the desired inclination of the level.

THE GREENERD ARBOR PRESS.

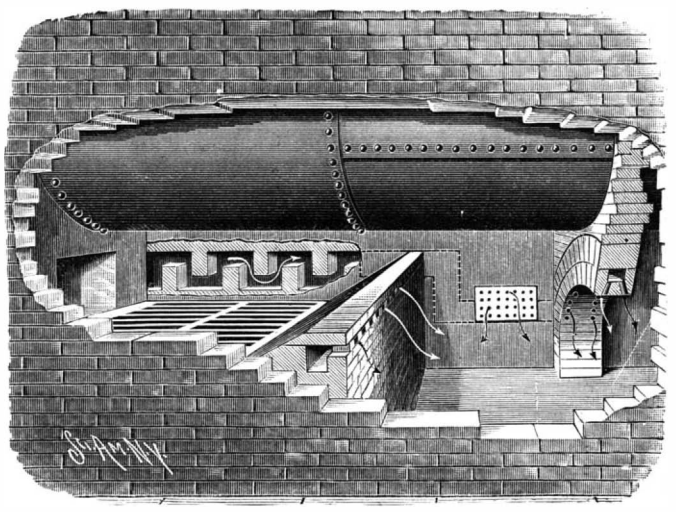
This new arbor press has many advantages over the old method of driving in and out the arbors. It saves moving, upsetting, or springing the arbors, and also saves clearing out the centers and taking off the dogs. It prevents defacing or otherwise damaging finished work. It preserves the arbors, and in their increased life will shortly pay for itself. It can be clamped to the end of the lathe bed, and will always be at hand. A large number are now in use, giving excellent satisfaction. Chandler & Farquhar, 177 Washington Street, Boston, are the manufacturers, and will give any additional information desired on application.



THE GREENERD ARBOR PRESS.

AN IMPROVED FURNACE.

In the furnace shown in the illustration, the products of combustion, after leaving the fire pot and passing over the bridge wall, are supplied with highly heated air taken in and fed through peculiarly arranged flues, causing a more complete combustion and consumption of the gaseous products and the diminution or entire prevention of smoke, with a proportionate economy in the use of fuel. This improvement has been patented by Mr. Lewis Lawton, of No. 202 Bayard Street, Trenton, N. J. The air supply flues are formed in the brickwork at either side of the fire box, as shown in the broken-away portion of one side wall of the fire box, the front ends of the flues being on either side of the fire box door, and there being partial partitions in them to lengthen the air passage, as shown by the arrow. These side flues communicate with a transverse flue in the bridge wall, near its upper edge, the latter flue having air outlets to the combustion chamber at the rear. The side flues are continued, as shown in the dotted lines, and also communicate with air passages opening into the sides of this combustion chamber, as indicated by the arrows, as well as with a transverse flue in an arch at the rear of the chamber, from which likewise heated air is supplied to mingle with the products of combustion. The mouths of the air supply flues at the front of the furnace may be provided with suitable draught regulators to govern the admission of air, the high temperature at which it may be delivered promoting the more perfect combustion of the gases and the production of a more intense heat.



LAWTON'S STEAM BOILER FURNACE.

Color Printing on Leather.

M. Canton, writing in *L'Industrie Textile*, describes a perfected method of printing on leather after tanning. The skins must be free from grease, and if they have been prepared with tannin, must first be steeped in a preparation of sumac. The application of the color can be done in several ways, according to the effect which it is desired to produce, and in one of several colors. It can be done by dyeing the skin and discharging with acids in certain parts, so that the natural color of the leather appears, or printing with a reserve composed of four parts of virgin wax, four of castor oil, one of borax, and one of copal resin, these ingredients mixed together and warmed. The castor oil may be replaced by any vegetable or mineral oil.

NEW BRIDGES AND ELEVATED RAILROAD CONNECTIONS IN NEW YORK.

On the small map we show the locations of two important bridges which it is proposed to construct across the East River between New York and Brooklyn. The idea of the scheme is to connect the elevated railroad systems of the two cities. The East River at the proposed points is about at its narrowest. The upper bridge starts from the Williamsburg or Eastern District of Brooklyn. The lower one starts from the heart of Brooklyn proper. The two converge, and on this side their approaches join at Cannon Street, between Delancey and Rivington Streets, well in the heart of this city. Extensive elevated railroad systems, all of which are shown on the map, are to put the bridges in communication with the New York City surface and elevated railroads.

The bridges are to be of the suspension type. The upper or north bridge will have cables 21 inches in diameter; between anchorages it will be 3,200 feet long, and it will have a clear span of 1,670 feet. At the piers it will be 120 feet, and at its center 140 feet above mean high water. The other bridge will have 18 inch cables, will be 2,700 feet between anchorages, and its span will be 1,470 feet. Its center will be 135 feet above high water. Thus the span of one bridge will be a little longer and of the other a little shorter than that of the present East River bridge. The cables will also be heavier than those of the present bridge, being 15¾ inches in diameter. All the piers will be 280 feet high.

The project has the backing of abundant capital and resources. It will bring two distant points of Brooklyn into connection with New York City and with the railroads and ferries which start therefrom. Thus a passenger can be carried on the proposed system to the West Street ferries of the Pennsylvania and other railroads. The elevated railroad connections will carry passengers to the New York Central and New Haven roads.

MAP SHOWING BRIDGES AND "L" CONNECTIONS.

THE NEW MAIL SAFETY BICYCLE.

This wheel is manufactured by the old house of William Read & Sons, 107 Washington Street, Boston, established in 1826. The wheel is of the straight Humber pattern, diamond frame, of Credenda tubing, all drop forgings. It has long 10 inch ball head, round 6½ inch cranks, ball bearings and ball head, 60 inch gear, single tangent spokes, is full nickel plated, and is furnished when desired with the inner tube style pneumatic tires. The same firm also have a new pattern lady's wheel with cushion tires or pneumatics,

THE NEW MAIL SAFETY BICYCLE.

and a boy's diamond frame. Wheelmen and the purchasing trade should see samples of these wheels before making their decision. The New Mail has been in the market ten years and hence there is nothing experimental about it. Catalogues will be sent upon request.

A Lively Centenarian.

Mrs. James Fellowes, mother of F. Wayland Fellowes, the artist, celebrated her 101st birthday at New Haven, Conn., on the 5th inst. Several generations were represented in the party which gathered to congratulate the old lady. Mrs. Fellowes is smart and a bright talker still.

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Correspondence.

DR. LANGLEY'S FLYING MACHINE.

To the Editor of the Scientific American:

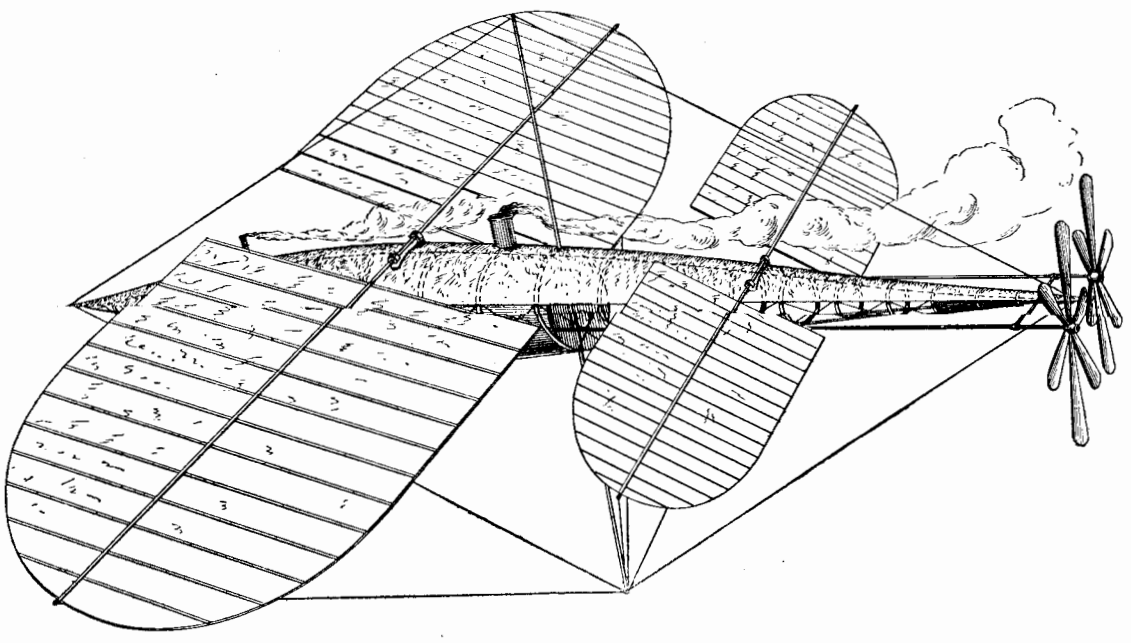
From the published descriptions of Professor S. P. Langley's flying machine the inclosed sketch is prepared. Of course it is not vouched for as to absolute accuracy, but conveys the general form of construction as stated in inclosed description taken from the daily press. The only apparent drawback to this particular method of aerial flight is in maintaining an upright position of the apparatus, free from the ground, until sufficient velocity is attained for soaring; and the means of alighting after flight. Other than the above mentioned difficulties (for which Professor Langley may have provided), the principle seems feasible, more especially when backed by so careful and competent authority. The article from which this sketch was prepared is as follows.

Ridgewood, N. J. H. E. MEAD.

[From the N. Y. *Herald.*]

It is stated that Prof. Samuel Pierpont Langley, the successor of Prof. Henry O. Baird in the control of the Smithsonian Institution, of Washington, which is under control of the government, has developed a flying machine which he believes is practicable. The machine is a working model. It is not intended to carry passengers. In configuration the body portion closely simulates a mackerel.

The backbone is a light but very rigid tube of what is technically known as "title metal," one of the many alloys of aluminum and steel. It is 15 feet in length and 5 centimeters (or practically 2 inches) in diameter. To give rigidity to the skeleton, longitudinal ribs of stiff steel are provided, intersected at intervals by cross ribs of pure aluminum, the result being a lattice framework of great strength. The engines, which



DR. LANGLEY'S FLYING MACHINE.

are located in the portion of the framework corresponding to the head of the fish, are of the double oscillating type. They weigh 60 ounces and develop one horse power—the lightest of that power ever made.

There are four boilers of thinly-hammered copper, weighing a little more than seven pounds each, and they occupy the middle portion of the fish. Instead of water, a very volatile hydrocarbon is employed, the exact nature of which is a matter of secrecy, but which vaporizes at a comparatively low temperature. The fuel used is refined gasoline, and the extreme end of the tail of the fish is utilized for a storage tank, with a capacity of one quart.

Before passing on to the boilers the gasoline is volatilized by going through a heated coil. There are twin screw propellers, which would be made adjustable to different angles in practice, to provide for the steering, but which in simply a working model are necessarily fixed at a certain point for a given trial.

Screws of various pitches and ranging from 20 to 80 centimeters in diameter have been experimented with, but it is not yet definitely determined which shall be adopted for trial. With the smallest the engines develop a speed of 1,700 revolutions a minute. With the larger ones the speed is somewhat decreased. A thin jacket of asbestos covers the upper portion of the body of the fish. It is unusually porous, and probably is employed to prevent undue loss of heat by radiation.

The wings, or aeroplanes, are sector-shaped and consist of light frames of tubular aluminum steel covered with China silk. The front one is 42 inches wide in the widest part and has an extreme length of 40 feet from tip to tip. The rear one is somewhat smaller. Both aeroplanes are designed to be adjustable with reference to the angle they present to the air. A tubular mast extends upwardly and downwardly through about the middle of the craft, and from its extremities run stays of aluminum wire to the tips of the aeroplanes and the ends of the tubular backbone, and by this trussing arrangement the whole structure is rendered exceedingly stiff.

The machine was constructed and perfected to its present degree in a secret room in the Smithsonian Institution, where it now rests. It was conceived about twenty months ago by Professor Langley, who associated with him in the work of experimentation Chief Clerk W. C. Winlock and Dr. Kidder, a scientific expert, employed at that time in the institution. Four skilled workmen in mechanics and metallurgy were put to work at fifty cents an hour under pledge of secrecy. The work went on at odd hours, mostly at night and on Sundays.

At the institution the strictest injunctions were laid on the watchmen to keep all intruders off the scent. The watchmen themselves were instructed to turn their backs or walk to the other end of the corridor when word was passed from the chief that some article was to be conveyed to or from the secret chamber. It is said that one employe was discharged merely for being seen on the third floor of the building. None of the regular employes were supposed to know what was going on there. As a matter of fact, very few of them do know that anything is there at the present time.

Professor Langley went to France to personally superintend the making of the central tube, which constitutes the backbone of the structure, and brought it back with him among his personal effects to insure careful handling. It is so light that it can be handled easily by an infant. During his French visit, while in touch with the most advanced investigators, he is believed to have reached his conclusion as to the best model for the general conformation of the proposed air craft—namely, the long, thin tapering lines of the mackerel.

In the large lecture room of the National Museum Professor Langley has succeeded repeatedly in producing successful flights by small models. They would fly as long as the power lasted, the power being applied by means of lightly wrapped rubber bands on the principle of the string top. The lightest of these little models weighs 16 grammes and will soar from one end of the room to the other as freely as a bird. It may be supposed that the gross weight has been so far reduced as to give hope of actual success now, inasmuch as an outdoor trial has been planned.

The intention is to employ a tug to tow the experimental party to a creek about 45 miles down the Potomac, where the experiments may be conducted without fear of interruption.

That 212½ Tons of Pig Iron.

To the Editor of the Scientific American:

I do not wonder that the statement of J. E. Emerson is doubted. But Mr. Andrews does not know what kind of a man Mr. Emerson was in his young days. Let me tell a little story about him.

In 1882 I was talking to a Mr. Carter, of Indianapolis, Ind., and he told me the following: "In the early days of California I owned a saw mill up in the mountains. One day a man came to me about the middle of the afternoon. He had a pack on his back, which I weighed and found to weigh 80 pounds. It was made up of hammers, straight edges, and inserted saw teeth blanks. On inquiry I found he had traveled over 40 miles that day over the mountains, afoot, and carried 80 pounds on his back. He wanted to insert teeth in my saw. After some talk he agreed to do the work and take an old broken saw I had for his pay. It was of no use to him, but there were quite a number of mills in the neighborhood, and it would be a good advertisement for him to get one running in my mill. I told him to go ahead. He went into my little blacksmith shop and went to work. He never stopped work from about 4 o'clock in the afternoon until 10 the next morning. Worked all night long. He had to file out the places in the saw where the teeth went in, and you know that is hard work. The result was that he got work in all the mills in the neighborhood. As he had walked to my mill 40 miles over the mountains and carried 80 pounds on his back, I did not have the cheek to pay him with a useless saw, but paid him in gold. That man was your father, J. E. Emerson." Now a man that could walk 40 miles over mountain roads with 80 pounds of steel on his back, and then work hard for 18 hours, mostly at night, is capable of handling 212½ tons of iron a day. I know of several other just such tricks as these that Mr. Emerson has done. It simply shows what Maine Yankees of those early days were made of. C. M. EMERSON.

Eau Claire, Wis., April 5, 1893.

The Lur.

To the Editor of the Scientific American:

Your issue of the 1st inst. contains a most delightful and readable account from a Danish correspondent of the "lure." Few of your readers can realize what an untold array of tradition, folk lore, anecdote and actual history the instrument in question stands for among the sons and daughters of the high north of Europe. What I desire more especially to call attention to in the premises is the fact, or apparent fact, of an early and remarkably high artistic evolution of the lure, as proved by the workmanship of the samples now in possession of the National Museum, Copenhagen; while yet the primitive instrument, the birch lure, from which it evidently grew, is still in daily use during the summer months, more especially among the Alpine meadows in western Norway. Deduct the curved neck of the instrument and also the wide semi-oblong mouth of the same, and what remains is the exact form of the lure as it is in use among the peasants of the western mountain regions in old Norway to-day, and has been for thousands of years, except that it is made of birch bark instead of metal, as are the Danish instruments.

The office of the lure among the peasants is largely that of soothing the cattle herds and calling them together in the evening, precisely as the cowboy does on the plains at night. He rides in a circle, gradually narrowing into a "round-up." The cattle lie down and drop off into rest and slumber under the witchery of a human voice known to them. The cattle of the Norse peasant are collected together in two or three small herds, the property of so many different families, and in June they are sent up into the Scandinavian Alpine meadows, which are no sooner bare of snow than the daily twenty hours sunshine and the twenty-four hours daylight covers every single square foot below the glaciers with the most nutritious and juicy grass sward.

No matter how feeble before arrival, they grow rapidly fat there. They are in charge of the oldest peasant girls of the respective families that own the cattle, but they do not herd them; they go loose very largely. They are there to milk the cows and to convert the dairy products into butter and cheese. It is in the evening, when the herd is recalled from the surrounding pastures, that the lure comes into play again. Many of the girls become quondam artists in its use, and manage to evoke a good deal of music from the primitive instrument.

It has, however, also a purely romantic use, more especially among the high-spirited peasants of the Trondheim districts of northern Norway. When a peasant girl has an engaged swain at work on the home farm he is supposed to be on the lookout for a lure signal from his prospective bride at any time, but more especially so on the Sabbath morning. Selecting the most commanding peak above the valley, in sight of the home farm, she seats herself on its summit at sunrise—that is between half past three and four A. M.—sending down over beetling crags and canons the choicest lure selections she is capable of. It is a challenge to her lover's devotion and punctualness, and woe to him if a prompt and melodious reply on the home lure is not at once forthcoming. She is then entitled, if she sees fit to demand it, to have the whole courtship renewed; at any rate, some act of penance must not be long delayed.

One of the most charming compositions ever written by the magician of the violin, Ole Bull, is the "Saeter Jentens" Sunday. The "Saeter" implies the mountain meadows, "Jenten" is the peasant word for an unmarried girl. No one that ever heard the wonderful strains but would catch, as in clear vision, the imposing grandeur of a scenery equal in power to and greater in magnitude from the Alps of Switzerland—a sunshine and an air as sweet and gentle as though it were the first morning of completed creation; while through it all came the echo of the lure, tender as the voice of the first meadow larks in spring. Such are a very few of the memories awakened by your interesting reminiscences of the Danish metal lure. Old-fashioned as seems the birch lure by comparison, I trust I have given you a few reasons why the mother instrument still holds its own. OLAF ELLISON.

Los Angeles, Cal., April 6, 1893.

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CRISTOBAL COLON DE LA CERDA, DUKE OF VERAGUA, MARQUIS OF JAMAICA.

(*Continued from page 244.*)

Committee of the Centennial, and afterward Vice-President of the Board of Directors of said Centennial; but he refused both of these honors on account of the delicate state of his health, which we sincerely hope he may recover.

As a matter of curiosity at the present historical moment, we give below the genealogy of the Dukes of Veragua, descendants of Christopher Columbus.

I. Duke of Veragua, Marquis of Jamaica, was Don Diego Colón, oldest son of the discoverer.

II. Don Luis Colón y Toledo, who added to the former titles that of Duke of Vega de la Isla Española, in Santo Domingo, by favor of Philip II., in 1557, and that of a Grandee of Spain.

III. Don Alvaro de Portugal y Colón, who interrupted the male line.

IV. Don Nuño Colón de Portugal.

V. Don Alvaro Jacinto Colón de Portugal.

VI. Don Pedro Nuño Colón de Portugal y Castro; joined to the titles of the house of Colón those of the Counts of Gelves, Marquises of Villamizar. This Duke was Captain-General of the Armada of Flanders and Viceroy, Captain-General and President of the Real Audencia de la Nueva España. He was decorated with the Toison de Oro (the highest order of knighthood in Spain).

VII. Don Pedro Manuel Colón de Portugal y la Cueva. He was Field Marshal of the States of Flanders; General of the Army of Cataluña and in the State of Milan; Governor and Captain-General of Galicia; Viceroy of Sicily and Captain-General of the Galeras de España.

VIII. Don Pedro Manuel Colón de Portugal y Ayala; he joined to the titles of the ducal house of Veragua and the Counts of Gelves those of the Marquis de la Mota y San Leonardo and Count of Ayala y Villalonso. He was Viceroy of Navarre and of Cerdeña; Senior Member of the Consejo de Guerra (Council of War); Gentleman in Waiting to Philip V., and his Secretary of State with the portfolios of the Department of the Navy, the Indies and Commerce. He enjoyed the dignities of Azuaga and of the Granja in the Order of Santiago.

IX. Doña Catalina Ventura Colón de Portugal y Avala.

X. Don Jacobo Francisco Eduardo Fitzjames Stuart y Colón de Portugal. He was Duke of Veragua, of Liria, of Jamaica and of Berwick, Count of Gelves, Finmouth, Ayala, etc.

XI. By decree against the house of Liria, the titles of the house of Veragua were inherited by Don Mariano Colón de Toledo y Larreategui Jiménez de Embrún, of the Council of Castile, President of the Treasury with the honors of Secretary of State. He had the Great Cross of Charles III. and of Isabella the Catholic.

XII. Don Pedro Colón de Toledo Baquedano Larreategui y Quiñones, Senator of the Realm, Caballero del Toison de Oro, Great Cross of Charles III. and of Isabella the Catholic, and Grand Officer of the Legion of Honor, father of

XIII. Don Cristóbal Cólon de Toledo de la Cerda y Gante, the present duke.

Although the Duke of Veragua is at the head of the Spanish Commission to the World's Columbian Exposition, it is as the representative of the family of Columbus that he is received by the United States government and the various State, city and Fair authorities. His visit will be attended by a series of balls, receptions and festivals of various kinds, beginning at the time of his arrival and continuing until his departure. He is said to be of unassuming manners, and having considerable influence in Spain. Commander Francis W. Dickins, of the U. S. navy, was detailed to receive the Duke on behalf of the government, and to accompany him on his tour through the country. After attending special services at the cathedral in New York City and a reception given by the Chamber of Commerce, and receiving other attentions, the ducal party will proceed to Washington by a special train, and the Duke will be presented to the President. The party will return to New York to witness the naval parade on April 27, and will then proceed to Chicago to take part in the opening ceremonies of the Fair on May 1.

How to Print a Photograph on Marble.

Mr. Villon publishes the following process: Coat an unpolished plate of marble with the following solution: Benzine 500 parts, spirits of turpentine 500 parts, asphaltum 50 parts, pure wax 5 parts. When dry, expose under a negative, which will take in sunshine, about twenty minutes. Develop with spirits of turpentine or benzine, and wash in plenty of water. Now cover the plate where it is intended to be left white with an alcoholic solution of shellac, and immerse the same in any dye which is soluble in water. After a while, when enough of the coloring matter has entered the pores of the stone, it is taken out and polished. The effect is said to be very pretty.—*Photographisches Archiv.*

An Excellent Suggestion Relative to Rain Making.

To the Editor of the Scientific American:

Being a constant reader of your valuable paper for the past fifteen years, I take the liberty to make this suggestion.

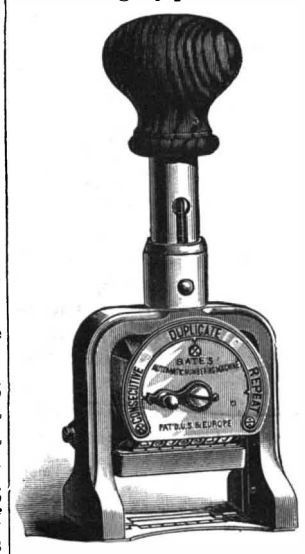
Having read numerous arguments pro and con. on the subject of rain making by concussion, should think that in view of the proposed explosion of powder in New York Harbor on April 27, those interested would make careful note of the condition of the weather, whether it is favorable to rain or not, and if not, and after the cannonading no rain comes, then I should think it would be conclusive evidence that there is no virtue in it; for from what I have read of the requirements to cause rain, and what the salute is to be, I should judge the concussions would be sufficient.

ELMER E. BAILEY.

Haverhill, Mass., April 9, 1893.

THE BATES' NUMBERING MACHINE.

This highly perfected hand numbering machine is entirely automatic, and a boy can readily understand and operate it. It is small and light to handle, insuring speed in operation, and is designed with special reference to office and factory use. Every wearing part is made of steel, including the figure wheels, so that it works with very slight friction and almost entirely without noise. Every figure disk changes automatically in its consecutive order, from 1 to the full numerical capacity of the machine, and these machines are made with a capacity of numbering up to ten millions. The ink pads are practically indestructible. We have had one of these numberers in almost constant use in our office for some time back, and it gives excellent satisfaction. It is made by the Bates Manufacturing Company, Edison Building, Broad Street, New York City.

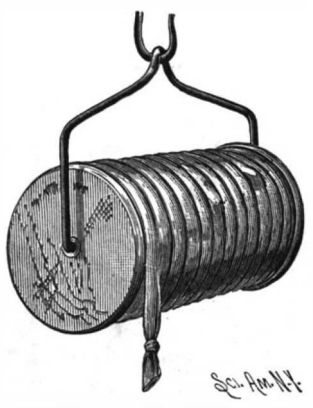


Another Wonder for Chicago.

It is rumored that a tall building is to be erected in Chicago in which there shall not be a stone, brick or piece of timber. Holabird & Roche have prepared the plans. It is to be constructed of an alloy of aluminum and copper—90 per cent of the former and 10 per cent of the latter—in the form of sheets over a wall of steel framed fireproofing. To a larger extent than is usual in such structures glass will be used, the windows being 22 feet wide. The structure, composed entirely of plate glass and shining pieces of aluminum, will, it is asserted, be as striking in appearance as it will be novel. The cost is estimated at $700,000.

A SAUSAGE CASINGS HOLDER.

The improvement shown in the picture provides a method of arranging and holding sausage casings which will enable an end always to be found, and by means of which also the casings will always be held straight and ready for use. It has been patented by Mr. Peter F. Turner, of No. 612 West Thirty-ninth Street, New York City. The casings are tied together, end to end, and wound upon a spool, instead of being indiscriminately bundled together in balls or packages, the spool being suspended in convenient position, so that in filling the operator can rapidly pull off the casings, cutting them on each side of the knot, thus facilitating their rapid handling, while the only parts wasted are the knots.



TURNER'S SAUSAGE CASINGS HOLDER.

The Lenox Free Library, New York.

The recent annual report to the Legislature by the trustees of the Lenox Library, New York City, shows that during the past year the library has received very large and valuable accessions.

Under the will of Mrs. Robert L. Stuart, who died in 1891, the library was made the legatee of all her books, paintings, statuary, bronzes, and other works of art, as well as her collection of minerals, shells, and other objects illustrative of natural history. They were to be placed, under the terms of the will, which were accepted by the trustees, in "a separate room or compartment of the library building," and to be known as "The Robert L. Stuart collection, the gift of his widow, Mrs. Mary Stuart."

For the purpose of carrying out these provisions, certain alterations were required; at the same time the whole interior of the building has been thoroughly overhauled and painted, and the whole put in perfect order.

Mrs. Stuart's library has been transferred and placed in the bookcases provided for it in the Stuart room. It comprises about 8,000 volumes, and is especially rich in fine illustrated works on natural history. Mrs. Stuart's paintings have been placed in the library. They number about 240, and comprise fine works by Durand, Cole, Kensett, Eastman Johnson, and other American artists, as well as foreign artists, such as Gerome, Rosa Bonheur, Bouguereau, Merle, Schreyer, Knaus, Munkacsy, and many others. The cases containing shells, minerals, and other objects illustrative of natural history required altering to adapt them to the room in which they are placed.

The trustees have acquired by purchase the original Spanish edition of Columbus' letter of 1493, which was discovered in Spain in 1890, and is the earliest printed book relating to America.

The American Inventor.

Of all the countries in the world, none is so prolific in inventions as America. There are several reasons for this. The ease of obtaining patents, and their cheapness, holds out to every man the chance of creating for himself a piece of property by the exercise of his brains. The high rate of wages insures the inventor of a labor-saving appliance a patient hearing from capitalists, while the independence of thought and feeling which pervades all classes leads to original views and to bold attacks on difficult subjects. Hence every one is a potential inventor, especially if he have an acquaintance with science or manufacture. Whatever a man's occupation, he must daily find himself called upon to do or to suffer many things from which he would gladly emancipate himself. The proverb says "There is a remedy for every ill but death," and seeing how many ills there are, the opportunities for devising remedies are not only numberless, but they are present to all. The unenterprising bear with patience the inconveniences that surround them, but those of active mind busy themselves in devising expedients to lighten the burden of life, and look for their reward under the provisions of the patent law. The inventor is the greatest benefactor of the human race, and especially of that part of it which is indigent; he is the real friend of the poor man, and indeed almost his only friend.

It is when we compare the condition of the poor to-day with that of previous ages, that we see how much the inventor has done for humanity. To know how hard life must have been before the advent of machinery, we have only to imagine a family set down on an island, and called upon to provide all their food and clothing without the aid of modern mechanical appliances—to plow and reap; to thrash, winnow, and grind; to raise cattle, kill and dress them; to shear, card, spin, and weave their wool; to make and mend their clothes; to provide soap, candles, tools, cutlery, earthenware, paper, pencils, nails, medicines, leather, boots, ropes, and the thousand and one things that are needed in a home. Evidently it could not be done, even if labor were continued from dawn to eve, and then extended far into the night. And this under the favorable conditions of a yeoman's family without rent to pay. How much worse must it have been under the exactions of a feudal landlord! Two-thirds of what we consider necessaries must have been omitted from the list of that day, and to sore toil must have been added scanty fare and insufficient clothing.

During the term of his patent the inventor, or his assignee, may make money out of it, but when it expires it practically becomes a gift to the masses. The producing power of the world has been increased manifold, without any corresponding increase in the consuming power of the upper classes. The wealthy do not eat more bread and meat to-day than they did years ago. Yet the output of these commodities has been vastly augmented, and they are consumed in large quantities by a section of the population which once seldom got flesh food, and often went short of bread. And so of nearly every other industry; the working classes take the bulk of what is produced, for the very good reason that they are able, by the aid of machinery, to turn out several times as much work in a day as could their forefathers. At the same time that their production has increased, their actual labor has diminished. A man with a heavy job in a foot lathe not only worked slowly, but painfully. When his long day was ended, every faculty was exhausted and he tramped home to rest, expended both in body and mind. Now he looks on while the lathe does the work, and in the evening discusses the provisions of the Employers' Liability Act. His hours, too, are shorter than they were, while the appreciation of gold which has taken place has enormously increased his wages by augmenting their purchasing power.—*Engineering, London.*

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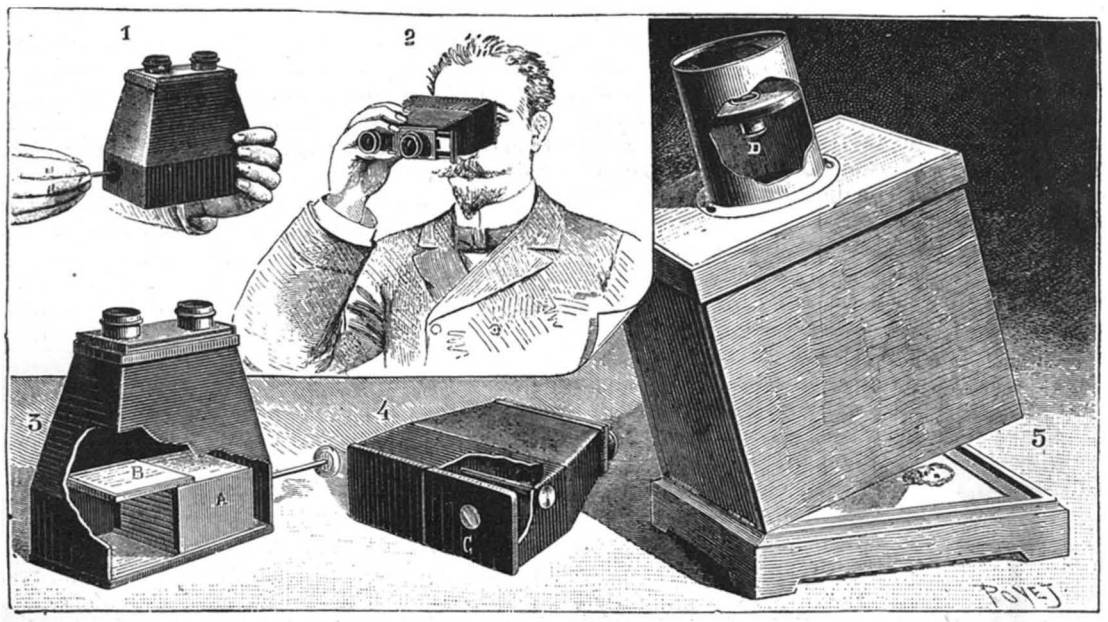
THE PHOTO-OPERA GLASS.

Photographic apparatus are now numbered by legions, and they are daily undergoing new modifications. It is very difficult for an amateur to make a selection, since every manufacturer has endeavored to meet a special requirement, and we believe that there is no universal apparatus. We shall always have three principal groups, viz. : the old model of bellows camera, uniting the conditions of long extension for the use of objectives of different foci, focusing, decentering, etc.; the magazine apparatus, containing, in the form of a rectangular box, all the material; and, finally, the pocket camera, which is one or the other of the two preceding of reduced dimensions. All these arrangements have their *raisons d'etre* and find their utility according to the times and places where they are to be employed. Another preoccupation of manufacturers has also sometimes been to so conceal the apparatus as to make it possible to take a photograph in secret. This has an interest especially for artists who are in search of truthfulness in the attitude of individuals. But, aside from a few apparatus that give almost microscopic images, there is nothing very complete in this respect.

Mr. J. Carpentier, an able electric engineer, who, in his spare hours, is a distinguished amateur photographer, has endeavored to solve this problem, and seems to us to have succeeded in it, by taking a mean term that consists in obtaining a negative of sufficient size (4·5 × 6) and in easily enlarging it to 15 × 18 by means of a special instrument of very simple manipulation. This apparatus consists of a double apparatus (Fig. 1) that may be carried in a case, provided with a strap passing over the shoulder, or even be put into the pocket. It contains twelve plates that are changed automatically. In order to operate, the opera glass is placed before the eyes (Fig. 2), and to a person not in the secret, the user seems to be looking at a landscape rather than taking a negative.

The apparatus is provided with two objectives: One of them, which is designed to impress the plate, possesses all the qualities of a good photographic objective, while the other, which is of the same focus, serves as a finder. The image that it gives is received on a plate of ground glass, and an aperture, C (Fig. 4) in the back of the opera glass permits of seeing it. This aperture is provided with a red glass that gives a monochrome image. This is a very happy arrangement, since it permits of obtaining a much better idea of the definitive negative. When, in an ordinary camera, we look at the image with all its colors, we run the risk of being deceived as to the relative value of the different tones that will be shown in the negative by a single color. It will be understood that we shall avoid such danger if we observe the image with a glass that permits of its being seen in but a single color. We recommend the use of this process, which is very easily put in practice and which, moreover, is already applied to a few finders capable of being adapted to any cameras whatever.



MR. CARPENTIER'S PHOTO-OPERA GLASS AND ENLARGING APPARATUS.

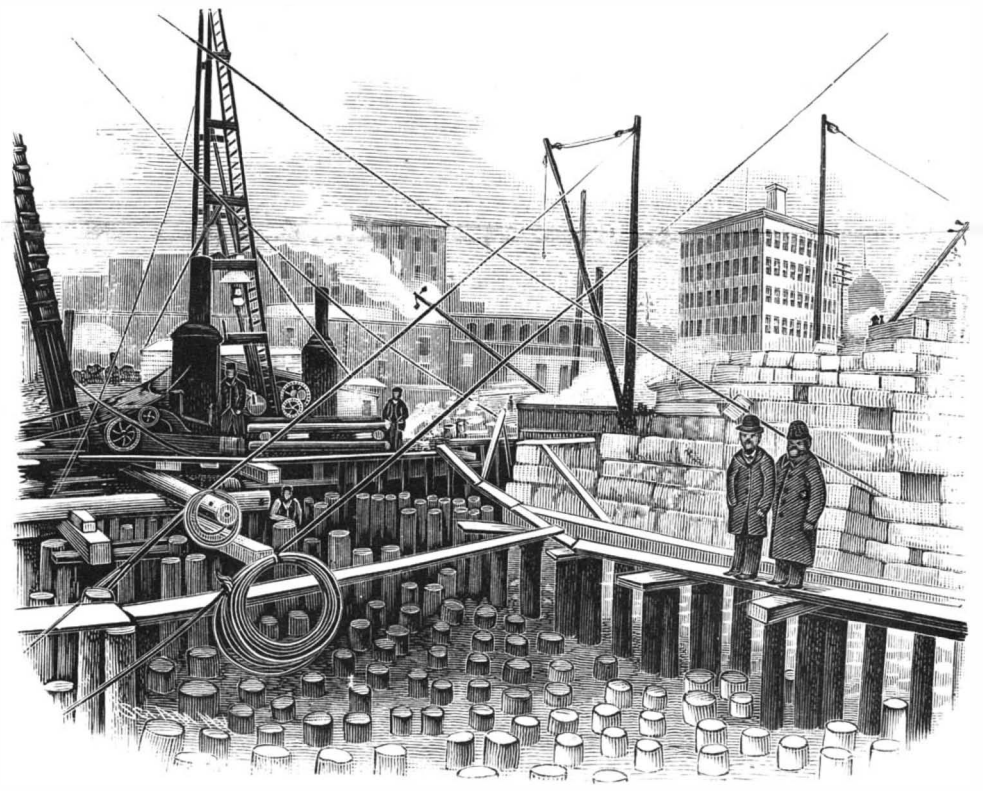
But to return to our opera glass: Behind the two objectives slides a metallic plate provided with an aperture. This is the simple drop shutter. It is so arranged that it can be set without uncovering the sensitized plate, and it is therefore useless to have a cap upon the objective; besides, it permits of seeing the image in the finder only when it is set – a second useful precaution, since in this way one cannot forget to set it at the moment of operating. The sensitized plates are contained in small independent frames of metal that are placed one upon another in the back of the apparatus in a drawer, A (Fig. 3). The first plate receives the impression as soon as the shutter is freed through pressure upon a button placed between the two objectives. In order to replace the impressed plate by another, one pulls a button placed upon the side of the apparatus, and thus displaces the drawer, A (Figs. 1 and 3). In this motion the first plate, B, remains held in place at first, and then, when the drawer is completely drawn out, drops to the bottom and becomes the last of the package after the drawer has been pushed back to its normal position. The top glass is then ready to receive an impression.

It will be remarked that in the motion that has just been effected the plates have been brought opposite the objective of the finder. But this is attended with no inconvenience, since at this moment, the shutter not being set, the finder is closed, as we have already explained. Moreover, in this motion, as each frame carries a number upon the back, such number presents itself opposite the red glass, C (Fig. 4), so that it is always possible to see how many frames remain to be used.

As may be seen, there is nothing easier than to obtain a series of negatives with the opera glass under consideration, and that, too, without being remarked. Printed of actual size, they will constitute a sufficiently valuable document, but with Mr. Carpentier's enlarging frame it is easy to at once obtain a 13×18. The enlarging apparatus (Fig. 5) consists of a square box whose bottom is hinged and carries a frame that permits of placing a sheet of paper sensitized with gelatino-bromide. This operation, of course, is performed in the laboratory. The upper part of this box is provided with a cylinder in whose extremity there is a recess for the reception of the small negative. An objective, D, immutably fixed, reproduces the enlarged and positive image upon the sensitized paper. To this effect, it suffices to step out of the laboratory and expose the apparatus for an instant to either diffused or artificial light. There is no need of focusing, etc., as all that is regulated in advance. It is thus possible to obtain a series of negatives or several positives from the same negative. Nothing remains to be done but to develop and fix by the ordinary processes.

On the subject of the photo-opera glass we have hitherto spoken only of instantaneous negatives, but it may prove useful to have an exposure. In such a case we employ a special arrangement occupying but little space and that permits of fixing the instrument upon a foot. The operation is then performed either with a cap or a folding shutter which is fixed to the extremity of the objective. The operator may thus obtain good results.

It may be seen that the apparatus devised by Mr. Carpentier is complete and well answers the object that he proposed to himself; that is, to have a compact apparatus that permits of obtaining a negative without attracting attention, and a positive large enough to constitute a useful document.—*La Nature.*



PILE FOUNDATIONS ELECTRIC POWER STATION BROOKLYN CITY RAILWAY.

COFFER DAM AND CONCRETE FUNNEL ETC.—FOUNDATION OF ELECTRIC POWER STATION.

THE CONCRETE FOUNDATIONS FOR THE ELECTRIC POWER HOUSE OF THE BROOKLYN RAILWAY COMPANY.

The Brooklyn City Railway Company is building a power house for their electric railroad at the corner of Division and Kent Avenues, Brooklyn, N. Y., near the edge of the East River. The greater portion of the foundation rests on piles and concrete. There will be three detached buildings—engine house, boiler house, and house for economizers.

The boiler house is to be 143 feet long and 91 feet wide, and will rest on piles. The strength of this foundation is shown by the method of building. Along the water side a coffer-dam, 143 feet long and 29 feet wide, was built, as shown in our illustrations. Piles were driven inside the

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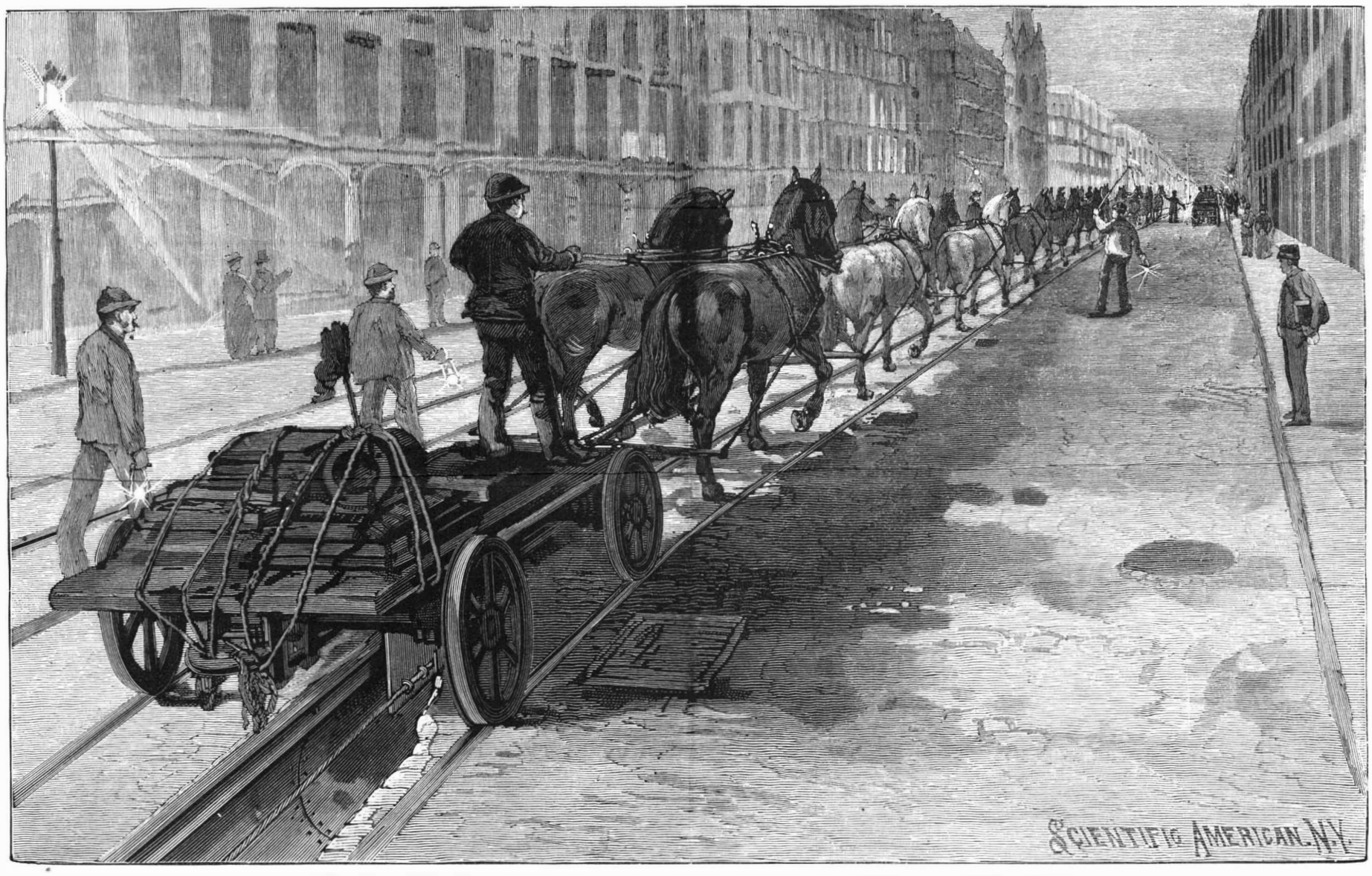
dam, 10 inches apart, 14 feet below high water; the water was pumped from the dam until it was only about 1 foot above the heads of the piles. The work was carried on during the severest weather of last winter. The water in the dam was heated slightly by means of steam pipes, then concrete was poured in by means of funnels and pipes, as shown, until the mass of concrete was 7 feet above the top of the piles. A granite foundation, 12 feet high, was then built upon the concrete, 8 feet 2 inches wide at the base and 5 feet 2 inches at the top. The piles for the remainder of the foundation were driven about the same distance apart, but only 1 foot below the water. A concrete mass 8 feet 6 inches thick was formed upon the piles. This concrete mass extends under the entire buildings. Two granite piers, 41 feet by 47 feet at the base, 44 feet 8 inches by 35 feet 5½ inches at the top, and 6 feet 8 inches high, were built as a foundation for the engines. The engine house will be 128 feet by 168 feet and 70 feet high. All of the buildings above the foundations will be of brick and three story.

The chimney will be the highest in Brooklyn, being 325 feet high. Stone foundations for chimney at the base, 60 feet square; five layers of stone, the upper layer 42 feet square. Brickwork at the base, 38 feet. Flue of chimney, 17 feet diameter.



THE BROADWAY CABLE RAILWAY NEW YORK—RUNNING IN THE CABLE.

The method of making concrete in winter time is of interest, as heat is important to prevent freezing until it can set properly. In this case the sand was heated by being packed around a large boiler, in which a fire was kept going all the time.

The broken stone was heated by being placed in a large tank of hot water. Hot water was also used in the mixing machine. By these means the concrete mass was kept warm until it had set. The granite blocks placed on the concrete were also heated by having fires built around them.

These particulars were kindly furnished by Mr. W. A. Tenney, C.E. W. H. Ward, of Lowell, Mass., has the contract for building, and Mr. P. Casseday is the superintendent.

THE BROADWAY CABLE RAILWAY, NEW YORK.

The change of the power of the Broadway street railroad, New York, from horse power to cable driving, which has been going on for over a year past, is now completed, and the cable cars will soon be in motion. The construction of the cable line proved to be one of the most difficult works of its kind that has yet been undertaken—not so much in the construction of the road proper as in overriding the vast network of pipes for water, gas, steam, pneumatic, telegraph, and telephone service which occupy this great thoroughfare. In uncovering the subway a bewildering combination of pipework was exposed. Pipes had to be depressed or carried to one side. Manholes for sewers, water pipe valves, and the telegraph subway had to be readjusted to clear the trackways. The engineers' fight was a severe one, but, by perseverance and persistence, the great work has been accomplished, and now Broadway, with its great cable road, involving an outlay of millions of dollars, and with its grand buildings, stands forth as the leading thoroughfare of the world.

The road extends from the south end of Central Park, at 59th Street, New York, along Seventh Avenue to its junction with Broadway at 42d Street, thence along Broadway south to the Battery and South Ferry, the extreme southern point of the city, where the waters of the Hudson and East Rivers unite on their way to the sea. The distance is between five and six miles.

The cables in their present limits embrace four principal divisions, each capable of being driven independently, and covering a total cable length of over 60,000 feet—more than eleven miles of running cable.

Throughout the whole line a spare cable will be laid ready for use in any emergency.

There are two power stations, where are assembled some of the most perfect and remarkable examples of driving mechanism ever constructed. One of these stations occupies the great stables formerly devoted to the welfare of the 2,000 horses heretofore employed by the company, on the block between Sixth and Seventh Avenues, 50th and 51st Streets.

Two of the cable divisions are here operated. The other power station occupies the lower part of the company's great building at the corner of Broadway and Houston Street.

We illustrate on our first page the magnificent engine room and power plant of the 51st Street power station.

The engines are of the latest style of Corliss type, made by the Dickson Manufacturing Company, Scranton, Pa. Cylinders 36 inches diameter, 60 inches stroke, each of 1,000 horse power.

The fly wheels are 24 feet diameter and weigh 80,000 pounds each. The main shafts are 18 inches diameter in the bearings and 20 inches in the swell, coupled to the main driving shaft with flanged couplings with bolts and cross keys. Upon the main shaft are four grooved driving wheels, each actuated by a friction clutch, making the use of any one or all of the driving gear under control for running or stopping, the driving pulleys hanging like a loose pulley on the running shaft when not in use.

The four driven wheels are grooved to match the drivers, are 32 feet in diameter; 20 cotton ropes 2 inches diameter are the transmitting medium for each of the four sets.

The large driven wheels are on separate shafts, each in pairs with friction clutches; each shaft connecting with one of the four cable drums, which are run in pairs and interlocked with gearing, so that any required repairs may be made to any one or two of the rope driving systems without stopping the cables in either direction.

The cable drums are 14 feet in diameter, with five grooves in each, to fit the 1½ inch cables, which are wound over and over the driving drums to obtain the necessary friction for driving the cables. One of the latest improvements in cable driving is introduced on these cable drums, consisting of an independent grooved friction ring for each wind of the cable, which allows the strain from unequal wear in the grooves to become equalized by a movement of the rings among themselves, instead of the drawing of the cable in the grooves of a solid driving wheel, which causes friction and wear. A system of traveling cranes is arranged overhead, covering all of the machinery in the room, giving the best and most modern facilities for erecting or removing the heavy parts of this ponderous machinery.

In the upper corner is illustrated the tunnel from the engine room into and under 51st Street to Seventh Avenue, blasted out of solid rock, lined and arched with brick, the engine room being located on the corner of 51st Street and Sixth Avenue.

Through this tunnel, which is nearly 1,000 feet long, the two outgoing and incoming cables for both the uptown and downtown sections are carried, turning a right angle on four large grooved sheaves placed under the street, two of which are shown in the cut.

The tunnel is lighted by electricity. At the opposite upper corner, first page, we illustrate a part of the power house at the corner of Sixth Avenue and 50th Street, used for the cable tension apparatus, which consists of large grooved wheels mounted on car trucks running on rails. The cables, coming from the driving wheels of this power room, pass over the tension wheels and back into the tunnel. The trucks are attached to a cable running over pulleys in the iron towers and fastened to weights adjusted to a proper tension for the running of the cables and for taking up the stretch and accommodating variations in length by changes of temperature.

After the roadbed for the Broadway cable railway was completed, it became necessary to run the cable into the interior of the slotted tube. This was done by means of a platform car weighted with iron. Projecting from beneath the car into the slotted tube of the roadbed was a strong colter, to the lower end of which the cable was attached at the power station. At 3 A. M., when the street was clear of traffic, the car was started, drawn by thirty-six splendid horses, and in the course of two hours a section of the cable was unreeled and run into the tube. Each cable section was run in the same way.

The illustration on this page shows the platform car and teams at work on Broadway, drawing the cable into the tube, as stated.

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Important Prizes Offered by the Smithsonian Institution.

In October, 1891, Thomas George Hodgkins, Esq., of Setauket, N. Y., made a donation to the Smithsonian Institution, the income from a part of which was to be devoted "to the increase and diffusion of more exact knowledge in regard to the nature and properties of atmospheric air in connection with the welfare of man."

With the intent of furthering the donor's wishes, the Smithsonian Institution now announces the following prizes to be awarded on or after July 1, 1894, should satisfactory papers be offered in competition:

1. A prize of $10,000 for a treatise embodying some new and important discovery in regard to the nature or properties of atmospheric air. These properties may be considered in their bearing upon any or all of the sciences—*e. g.*, not only in regard to meteorology, but in connection with hygiene, or with any department whatever of biological or physical knowledge.

2. A prize of $2,000 for the most satisfactory essay upon—

(A) The known properties of atmospheric air considered in their relationships to research in every department of natural science, and the importance of a study of the atmosphere considered in view of these relationships.

(B) The proper direction of future research in connection with the imperfections of our knowledge of atmospheric air, and of the connections of that knowledge with other sciences.

The essay, as a whole, should tend to indicate the path best calculated to lead to worthy results in connection with the future administration of the Hodgkins foundation.

3. A prize of $1,000 for the best popular treatise upon atmospheric air, its properties and relationships (including those to hygiene, physical and mental). This essay need not exceed 20,000 words in length; it should be written in simple language, and be suitable for publication for popular instruction.

4. A medal will be established, under the name of The Hodgkins Medal of the Smithsonian Institution, which will be awarded annually or biennially, for important contributions to our knowledge of the nature and properties of atmospheric air, or for practical applications of our existing knowledge of them to the welfare of mankind. This medal will be of gold, and will be accompanied by a duplicate impression in silver or bronze.

The treatises may be written in English, French, German or Italian, and should be sent to the Secretary of the Smithsonian Institution, Washington, before July 1, 1894, except those in competition for the first prize, the sending of which may be delayed until December 31, 1894.

The papers will be examined, and prizes awarded, by a committee to be appointed as follows: One member by the secretary of the Smithsonian Institution, one member by the president of the National Academy of Sciences, one by the president, pro tempore, of the American Association for the Advancement of Science; and the committee will act together with the secretary of the Smithsonian Institution as member ex officio. The right is reserved to award no prize if, in the judgment of the committee, no contribution is offered of sufficient merit to warrant an award. An advisory committee of not more than three European men of science may be added at the discretion of the Committee of Award.

If no disposition be made of the first prize at the time now announced, the institution may continue it until a later date, should it be made evident that important investigations relative to its object are in progress, the results of which it is intended to offer in competition for the prize. The Smithsonian Institution reserves the right to limit or modify the conditions for this prize after December 1, 1894, should it be found necessary. Should any of the minor prizes not be awarded to papers sent in before July 1, 1894, the said prizes will be withdrawn from competition.

A principal motive for offering these prizes is to call attention to the Hodgkins Fund and the purposes for which it exists, and accordingly this circular is sent to the principal universities and to all learned societies known to the institution, as well as to representative men of science in every nation. Suggestions and recommendations in regard to the most effective application of this fund are invited.

It is probable that special grants of money may be made to specialists engaged in original investigation upon atmospheric air and its properties. Applications for grants of this nature should have the endorsement of some recognized academy of sciences, or other institution of learning, and should be accompanied by evidences of the capacity of the applicant, in the form of at least one memoir already published by him, based upon original investigation.

To prevent misapprehension of the founder's wishes it is repeated that the discoveries or applications proper to be brought to the consideration of the Committee of Award may be in the field of any science or any part without restriction; provided only that they have to do with "the nature and properties of atmospheric air in connection with the welfare of man."

Information of any kind desired by persons intending to become competitors will be furnished on application.

All communications in regard to the Hodgkins Fund, the Hodgkins Prizes, the Hodgkins Medals, and the Hodgkins Fund Publications, or applications for grants of money should be addressed to S. P. Langley, Secretary of the Smithsonian Institution, Washington.

Decisions Relating to Patents.

INVENTION.

In letters patent No. 367,484, issued August 2, 1887, to Jeremiah M. Watson, claim 1 is for a machine for compressing shank stiffeners, having "two rotating die or compressing rollers, the meeting faces of which are formed to present a recess, having one straight and one curved face or side, to thereby curve transversely one face of the stiffener," etc. Claim 6 is for a method of finishing the edges of shank stiffeners, consisting "in cutting out a blank from a sheet of material, leaving the same with beveled edges and obtuse-angled corners, and thereafter passing the same between rolls having dies with rounded edges or margins, in order to round the obtuse angles and beveled portions as cut. It is held by the Circuit Court of Appeals that, in view of the fact that the patented machine is the only one thus far discovered operating with efficiency, rapidity, and economy, the patent is not void for want of invention over the prior machines having reciprocating instead of rotating dies, although ordinarily the one is only the mechanical equivalent of the other. 1.

The Circuit Court decides that letters patent No. 465,485, issued December 22, 1891, to Levi Maybaum, for "means for securing against excessive losses by bad debts," being a plan of insurance against losses from bad debts based on estimates of the different percentages of loss in different lines of business, and providing forms for ruling paper, with spaces for entering various details of the insurance transaction, are void for want of invention. 2.

The Circuit Court rules that letters patent No. 337,006, issued March 2, 1885, to David C. Mahon and others, for a "bending block," consisting of a block or former adapted to the bending or shaping of the loop in guide rods for grain car doors, are void for want of patentable invention. 3.

PRELIMINARY INJUNCTION—WHEN GRANTED.

Letters patent No. 258,295, issued to Halstead, May 23, 1882, cover an egg-holding tray for incubators, having wires or cross bars, in combination with a muslin web below the same, on which the eggs rest, and which is movable by means of rollers so as to turn the eggs. In his application the patentee claimed as his improvement an arrangement whereby the eggs rested between cross bars not supporting the eggs, and disclaimed cross rollers on which the eggs rest. In defendant's incubator the eggs rest upon a cloth supported by cross bars, and the cloth revolves on rollers, but the rollers serve both to support the eggs and to hold them in place while the cloth is moved to turn them. Defendant's device had greater likeness to a prior patent than to that of complainant. There was no evidence that serious injury would be caused by withholding a preliminary injunction. The Circuit Court lays it down that the same should be denied. 4.

Letters patent No. 368,249, issued in 1887 to George H. Stahl, cover in claim 3 an incubator in which uniform heating is secured by a flat tank overlying the chamber, and divided by two partitions extending from one end nearly to the other, the hot water being discharged by pipes into the outer divisions, and carried off by a single return pipe, leading from a point between the partitions. Defendant substitutes pipes for the partitions, and it appeared that the patentee originally claimed substantially similar pipes, but, the same being rejected, he disclaimed the use of pipes for maintaining an even temperature. The Circuit Court holds that the claim should be strictly construed against him, and that a preliminary injunction should be denied, especially as it appeared that both pipes and partitions had been used prior to the patent. 5.

LIMITATION.

Letters patent No. 164,425, issued June 15, 1875, to Stephen Chester, for an improvement in fire alarm signal boxes, cover, in the third claim, "the combination of an independent pinion or equivalent device with a wheel, sector, or rack, and a key or equivalent implement which may pass through an orifice in a closed door, for the purpose of winding a spring or raising a weight." This claim was inserted after the rejection of a broad claim for the "winding up and preparing for action the motive force of said apparatus by turning the key, or similar device, inserted in the keyhole of a closed door or cover." It is decided by the Circuit Court that in view of this action and of the fact that the combination of a pinion, wheel, sector, or rack with a key or its equivalent, passing through an orifice in the door for the purpose of winding a spring or raising a weight, was old at the time of the invention, the claim must be limited to the specific devices set forth, or their equivalents, and is not infringed by a signal box in which the devices are widely dissimilar. 6.

Letters patent No. 344,430, issued June 29, 1886, to John C. Wilson, for an electric signal box, cover in claim 6 a box in which a citizen's key removes an obstacle from the signaling crank, and the signal is then operated by turning the crank, whose handle projects through the door. The key, after performing its function, is entrapped so as to prevent its withdrawal by means of mechanism operated by the movement of the door, the key being held while the door is closed, and released when the door is opened. The claim is for a signal box in which the mechanism is "controlled" by a key, etc. The Circuit Court rules that, in view of the prior state of the art as shown by letters patent No. 157,002, issued November 17, 1874, to Z. P. Hotchkiss, and by the Wright, Holley & Miles patent of June 17, 1873, the claim cannot be construed to cover a signal box in which the transmitting mechanism is operated directly by the key, and without any further action by the operator. 7.

ACQUIESCENCE IN PATENT.

On a motion for preliminary injunction the patentee made affidavit that he put the invention into practical use about the time of the application, and it had been in practical use ever since; that the rights of the owner of the patent had been acquiesced in by the public; that the invention had been applied to many hundred machines; that he had never given any licenses, or sold any manufacturing rights; and that the validity of the patent had never been questioned. The assignee of the patent made affidavit that he had applied the patent since January, 1892. The Circuit Court holds that this was insufficient to show public acquiescence. 8.

WHO ARE INFRINGERS.

The Circuit Court decides that a person who is employed as manager of a partnership, and who in that capacity sells an article which infringes a patent, is guilty of infringement, and may be enjoined, but he will not be compelled to account if it fails to appear that he had any interest in the sale. 9.

1. Watson *v.* Stevens, 51 Federal Reporter, 757.
2. U. S. Credit System Co. *v.* Am. Indemnity Co., 51 Federal Reporter, 751.
3. Mahon *v.* McGuire Mfg. Co., 51 Federal Reporter, 681.
4. Stahl *v.* Williams, 52 Federal Reporter, 648.
5. Same.
6. Gamewell Fire Alarm Tel. Co. *v.* Municipal Signal Co., 52 Federal Reporter, 471.
7. Municipal Signal Co. *v.* Gamewell Fire Alarm Tel. Co., 52 Federal Reporter, 468.
8. Stahl *v.* Williams, 52 Federal Reporter, 648.
9. Featherstone *v.* Ormonde Cycle Co., 53 Federal Reporter, 110.

The Austrian Plate Glass Industry.

The United States consular officials in Vienna and Prague have sent reports to the government on the plate and mirror glass industries of Austria, which contain much technical detail. It seems for over two centuries the mirror glass industry has been established in Bohemia, just across the Bavarian border, where the surrounding forests guaranteed a plentiful and cheap supply of fuel. At first glass for beads and bottles only was produced. In the latter half of the last century Bohemia held the first place among the glass-producing countries of the world. The value of the glass manufactured there in 1799 amounted to about a quarter of a million sterling. Early in this century, however, the markets began to be flooded with cheap English and French pressed crystal glass, with which Bohemian glass could not compete, and notwithstanding the efforts of Bohemian glass manufacturers, the decline of the industry was inevitable. In recent years it has revived, and there are now in Bohemia about 150 glass works and nearly 3,000 grinding establishments, employing nearly 30,000 persons. There is a number of glass works in other Austrian provinces, and in Hungary there are over 70 in operation. The chief factories for producing plate and mirror glass are situated near Pilsen, in Bohemia. The value of these kinds of glass depends on the purity, and the greatest possible care is therefore taken to procure materials of the very best quality, and almost every manufacturer guards the formula of his own special mixture as a trade secret. The substances used, though the proportions differ, are quartz, purified potash, hydrate of lime or marble, saltpeter, arsenic, manganese, and smalt. The reports enter into numerous details of the various processes of manufacture—blowing, rolling, grinding, smoothing, and polishing.

THE LENGTH OF THE DAY.—By a simple rule the length of the day and night, any time of the year, may be ascertained by simply doubling the time of the sun's rising, which will give the length of the night, and double the time of setting will give the length of the day.

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RECENTLY PATENTED INVENTIONS.

Electrical.

SEPARATOR FOR BATTERY ELEMENTS.—Chaimsonovitz P. Elieson, New York City. The cells of batteries having outer and inner electrodes are, by this invention, separated by means of a skeleton frame of insulating material open at one end and having slotted sides, the frame being adapted to contain the inner electrode and fit snugly between the two electrodes. The outer and inner electrodes are thus held in fixed relative positions, while the separator also serves to strengthen and support them.

TROLLEY POLE CATCHER.—Edward L. Langheinz, Brooklyn, N. Y. A set of counteracting springs are supported on the bracket frame that sustains the trolley pole foot support, the springs being stronger than the lifting springs for the pole, and held dormant but in tension by mechanism which releases them when impinged by adjustable blocks on vibratable attachments of the pole. A simple attachment is thus provided for a trolley bracket foot on a car, to serve as a guard and counteract the force of the lifting spring for the pole on the foot piece, preventing a sudden, abnormal elevation of the pole and trolley on it, should the trolley be released from contact with the line wire.

Mechanical.

BENCH CLAMP.—Erik Olson, Neihart, Montana. The frame of this clamp can be conveniently swung into horizontal or vertical position, according to the size of the object held, which can be readily clamped, no matter what the position of the frame. The latter is approximately U-shaped and provided with an apertured cross bar, while it has a hinged joint at the upper end of its inner arm, a clamping arm being pivotally connected at its lower end with the cross bar at any desired aperture and a screw extending through the outer frame into engagement with the clamping arm.

BUILDER'S JACK.—John Callahan, Durango, Col. This jack has two rectangular sockets, one of which has attached to its inner end a hub threaded to receive the end of a screw, the head portion of which is swiveled in the inner end section of the opposing socket, the screw being operative so as to bring the sockets toward each other or force them apart by means of a head attached to the neck of the screw. The jack is especially adapted for squaring or adjusting window frames or sashes, and other similar work.

BURNISHER.—Thomas Lloyd, Boston, Mass. This is a tool to be operated by hand for burnishing or polishing boots or shoes, metal goods, or other articles to be brightened by rubbing. The working face is formed upon a casing filled with sponge, hair, or other suitable springy material, and the rubbing or working face consists of a firmly fastened loose fibrous coating. A clamping device forms the back and handle of the cushion casing, a base piece and top piece being held together by screws or bolts in such manner that the clamping device and handle may be easily applied to a cushion, and when one cushion is worn out it may be applied to another.

SAWING MACHINE.—John H. Peterson, Portland, Oregon. This is an improvement on a formerly patented invention of the same inventor, providing a slitter which is simple in construction and effective in operation, and arranged to prevent the feeding of material not having the proper thickness. The machine has a feed table leading to revoluble saws, with front and rear top and bottom feed rolls, pivoted frames carrying the top rolls and a bolt connecting the frames, while an expansion gear connects the bottom feed roll shaft with the corresponding top feed roll shaft, to impart a uniform motion to all the feed rolls.

CENTRIFUGAL PUMP OR VENTILATOR.—Auguste Rateau, St. Etienne, France. Surrounding a conical wheel is a casing having a passage or throat whose radial diameter increases from its inception, while an exterior volute passage is adjacent to and surrounds the throat, the latter passage being also of progressively greater cubical capacity from its inception. The wheel mounted in the casing has a toro-conical base and curved and tapering wings with concave upper longitudinal edges. The parts are so arranged as to permit the fluid, air or water, to circulate rapidly, and avoid friction as much as possible.

Railway Appliances.

TRACK MOWING MACHINE.—Joseph Sindelar, Ipswich, South Dakota. This is a machine designed for use on railroads, to cut the weeds growing on the track inside and outside of the rails. This machine has independent cutting mechanisms having a vertically and also a laterally yielding movement away from the rails, two being between the tracks, one in front of the other, and two outside of the tracks. The machine is preferably arranged upon a hand car, and the cutters between the rails are designed to pass over fishplates or other obstructions in the roadbed.

Agricultural.

RAKE.—Robert J. Schneider, New York City. Wooden rakes, used for raking hay, etc., are designed to be improved by this invention, to increase their holding capacity, while the several parts of the rake may be easily put together when the rake is made. The handle is fastened to the head of the rake in such a way that neither the head nor handle is perforated, making the rake very strong.

SEED COTTON CLEANER AND CONVEYOR.—Ferdinand E. Smith, Birmingham, Ala. The cotton, with its seed and impurities, as it comes from the field, is fed to this cleaner by pneumatic action, an induction pipe for the cotton and air opening into the upper part of a casing in which is a cylindrical screen revolving about a vertical axis, there being near the bottom a suction pipe for carrying off sand and dirt, while a discharge valve operates automatically to carry off the cleaned cotton without impairing the draught. The revolving screen presents a constantly clean and new surface to the impact of the cotton, which drops from gravity as the screen revolves.

FRUIT GATHERER'S COAT.—Robert D. Maund, Geneva, Ga. This is a sleeveless garment made double throughout to form a receptacle, between its inner and outer portions, and with pocket holes in front and a spout leading from its lower front portion. The discharge of the fruit may be facilitated by a cord passing from the lower rear portion of the garment over the shoulder, the cord passing through an eyelet.

Miscellaneous.

CAISSON DRIVER.—Theodore F. Perrenot, Rockport, Texas. This invention relates to apparatus for sinking caissons in gravel or mud for bridge foundations, jetties, etc. It comprises a frame with parallel vertical guideways in which are mounted slide blocks to engage the upper edge of the caisson at opposite points, while connected at their upper ends is a series of vertical pipes descending between the guide blocks and having discharge outlets at their lower ends to form jets to loosen the material on which the caisson is to be sunk and face it outwardly, water being forced under pressure through the pipes. The pressure is applied to the caisson by means of tackles so arranged that great power may be obtained.

APPARATUS FOR EXCAVATING WELLS, ETC.—George A. Miller, Colfax, Washington. A former patent of this inventor provided for excavating by an explosive, upon which a hammer was dropped, and the present improvement is for removing the loosened material. A steel head or shoe has a central opening and other passages provided with check valves connected with tubes, a reservoir receiving the material delivered from the tubes, while a device which reciprocates through the shoe alternately performs the functions of a drop hammer and the piston of a force pump. The shoe forms a barrier to resist the explosive action of the torpedo, and when the hammer or piston is dropped, the water, slush and disintegrated mass is forced up the tubes into the reservoir.

COMPUTING SCALE BEAM.—Frank M. Daniels, Traverse City, Michigan. This scale beam is provided with a number of counterpoises, by properly manipulating which the price of a certain weight of goods is indicated. The device will also indicate the amount of goods which may be sold for a certain price, and it may be used for weighing goods in the ordinary way.

THILL COUPLING.—James S. Patten, Baltimore, Md. The thill iron of this coupling has at its lower end a head to engage the thill seat, and a latch has its stem bent around a portion of the head, whereby the latch is pivotally connected. The invention also embraces other novel features, providing a spring support for the thill, and furnishing means by which the thill iron may be coupled to the clip and held without anti-rattling springs or rubbers, to avoid rattling, take up wear, and permit the easy adjustment of the thill iron and its removal without the unscrewing of nuts or bolts.

WIRE STRETCHER.—Lemuel A. Scarbrough, Memphis, Tenn. This is a cheap and simple form of hand lever stretcher which can be used to force the wire against the post without carrying the stretcher around the post. The handle is bifurcated at its forward end, the sides of the bifurcation being provided with metallic plates with laterally projecting prongs at their forward ends. The device is adjustable for thick or thin wire.

TAN LIQUOR HEATER.—Ross Owens and Myron Lewellyn, Olean, N. Y. This heater has upper, lower, and intermediate steam-supplied heating pans, between which are arranged two liquor pans, all of the pans having ports and passages in their sides. The apparatus can be quickly set up or taken down, and can be readily cleaned when desired, and in it the liquor may be gradually and properly heated as required, by steam or other heating medium.

SHIELD FOR BUILDINGS.—William Durkin, Philadelphia, Pa. This invention provides a protection for buildings to prevent dampness rising above the first floor, and to keep out vermin. It consists of metal shields with side flanges arranged above and below the foundations, one flange extending beyond the outer face of the wall and the other beyond its inner face to an engagement with the joists. The shield may also be applied to all piers, arches, and center walls of any structure.

PERMUTATION LOCK.—Leopold Kaplan, Berlin, Germany. This is a keyless lock which may be locked by merely pressing upon a knob and moving any one of a series of locking slides, the unlocking being automatically effected when the locking slides are brought in a certain position. The bolt is engaged by a pivoted spring-acted latch moving transversely of the case, and the lock is controlled by one or more locking slides and permutation disks, the slides being actuated by racks operated by pinions upon the spindles of which the permutation letter disks are arranged.

FILTER.—John H. Bellamy, New York City. This is a device adapted for convenient attachment to the water service, and is designed to retain all the impurities of the water flowing through it, the construction being such that the interior parts of the filter may be readily cleaned. The casing is adapted to screw on the faucet of the water service pipe, and the water passes through a strainer and thence through a filtering vessel containing sand, charcoal, etc., as a preliminary vessel, after which it passes through another strainer and a porous stone.

DEVICE TO STOP RUNAWAY HORSES.—Leon Chauvin, Sr., Cairo, Egypt. A plate and spring, with attached pointed pin or pricker, are, according to this invention, arranged to be held between the nostrils of the horse, under control of the reins, so that when desired the device may be operated to prick the horse on the end of its nose between the nostrils.

VEHICLE TOP.—Jack C. Griffis, Gipsy, Ala. This invention provides an attachment for the seat rail of an ordinary top buggy by which the slack of the top stays may be readily taken up. It consists of parallel clips to be secured to the rail, revoluble winding bolts journaled in the clips being secured to the lower ends of the top stays, with fastening devices to lock the bolts. The device is very cheap, strong, and simple, and can be readily placed on the rail of any ordinary buggy seat.

PRODUCING LITHOGRAPHIC DRAWINGS.—Franklin F. Haggenmuller, New York City. This invention covers a method of transferring to the grained surface of the stone an impression taken with acid-resisting ink from an ink-stippled surface, covering the stippled surface with asphalt or an equivalent, removing the asphalt, except that which adheres to the stipples, etching the unprotected part of the stone, removing the ink stipple, washing the surface with acid to remove fatty matter, covering the surface with asphalt or other ink-taking substance, and then removing the latter either wholly or partly at the required points according to the toning effect desired.

MANUFACTURING ARTIFICIAL BONE.—Robert Reiman, Egg Harbor City, N. J. This invention covers a process consisting in separating or dividing by chemical action the constituent parts of raw or natural bone in a finely comminuted state, and, after preparation by precipitation and washing, mixing them together with substances operating to produce a hardening effect and to develop the original bone substance into gelatine by a high heat, at the same time keeping the mass under strong pressure in suitable moulds or receptacles.

LEAD PACKER.—Clarence E. Dawson, Joplin, Mo. A packing machine to pack white lead or similar paint in barrels, solidly and in desired quantities, at the same time permitting the rapid escape of the air, is the object of this invention. A cylinder is inserted in the barrel, and a lead supply pipe and plunger are worked up and down in the cylinder, a supply of paint being admitted at every up stroke, which takes place gradually, while the paint is held and the air released on the down strokes. The fumes are all forced back into a blast pipe, and cause no flying dust or paint, and it is not necessary for any one to be near enough to inhale any escaping fumes.

FRUIT OR VEGETABLE STAND.—James J. Farrell, Brooklyn, N. Y. Thisstand has a connecting cross piece, outwardly swinging side pieces hinged to the posts and their free ends having angular projections, a hinged collapsible top, and guard rails resting on the top and in the projections of the side pieces. It is strong and simply made, can be folded into small space, and easily set up and arranged to display articles to advantage and carry a large quantity of goods.

HEAD REST FOR CHAIRS.—John L. Baker, Baird, Texas. Barbers' and dentists' arm chairs may advantageously have a head rest such as here designed, facilitating the adjustment of the head of an occupant of the chair, and enabling it to be changed in position laterally without raising it from the support it rests upon. The rest comprises a vertically adjustable bar on the upper end of which a frame is adjustably pivoted, parallel rollers being mounted in the frame to revolve in either direction, and an endless band inclosing the rollers.

HAIR DRYING MACHINE.—Joseph N. Powell, Elmwood, Ill. Heated air may, by this machine, be forced through the hair after shampooing, and thus quickly and nicely dried. A lower chamber containing a lamp is connected with an upper chamber in which is a fan, to draw out the heated air and force it through a perforated top of the case immediately behind the chair in which one sits, with the hair spread out over the perforated top. The fan is rotated by a crank handle, so connected that the fan may be moved very rapidly.

BODICE FOR BELTS.—Charles Scherer, Brooklyn, N. Y. The upper and lower ends of the bodice, when constructed according to this invention, are in no danger of turning outward or curling up, while the bodice is arranged to perfectly fit the wearer's waist. The belt is made as usual, and the bodices each have a vertical slot, made by cutting out the material in almond shape, and lacing it together.

BRAKE FOR BABY CARRIAGES.—Elmer J. Wells, Nashua, Iowa. The brake car of this device has lever arms carrying brake shoes, and hangers to which springs are attached at one end and at the other end to a projection on the brake bar. The brake may be adjusted for carriages of different sizes, and to act on either the front or rear wheels, and is operated by a setting lever forming the main part of a toggle joint that serves to lock the wheels until the brake is released by the tripping of the lever.

SURGICAL APPLIANCE.—Frank Orth, 89 Brown Street, Anderson, Ind. An apparatus to be fastened to the body is provided by this invention, designed under certain conditions, by closing an electric circuit, to cause a fan to be operated for cooling purposes, the patient being awakened by a bell if desired.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

PIONEERS OF SCIENCE. By Oliver Lodge. With portraits and other illustrations. London and New York: Macmillan & Co. 1893. Pp. xv, 404. Price $2.50.

Professor Lodge states that this book takes its origin in a course of lectures on the history of progress of astronomy, arranged for him in the year 1887 by three of his colleagues, one of whom gave the course its name. Who this one was the professor does not divulge. So we are left in some doubt as to the authorship of the book. It presents the work of the early astronomers, and naturally brings forward some of the more recent discoveries of the science. The presentation is eminently practical, and in the present time, when so much is being done for the popularization of astronomy especially, the work will find most interested readers. According to the preface, the work should be a pretty good one, at least the writer of the preface states that in no case has it been allowed to become technically and generally unreadable, which it is to be hoped will prove true. In one portion we notice a curious alternation of past and present tenses in consecutive sentences, which produces a rather peculiar effect. The proper title to the work would have been "Pioneers of Astronomy," as it is really limited to such.

EXPERIMENTAL SCIENCE. By George M. Hopkins. Fourteenth edition. Revised and enlarged. Pp. 840. Price in cloth $4. Half morocco $5.

The great popularity of this book has been a sufficient warrant for the publication of a new and revised edition, enlarged by the addition of 120 pages of new matter and 110 superb cuts. The new matter relates to live subjects, such as, for example, the scientific use of the phonograph, optical projection of opaque objects, some new things in photography, how to color lantern slides, new electrical apparatus, systems of electrical distribution, the study of the stars, and a great deal of new material which is of interest to scientific readers.

WILLIAM GILBERT OF COLCHESTER, Physician of London, on the loadstone and magnetic bodies, and on the great magnet the earth. A translation by P. Fleury Mottelay. New York: John Wiley & Sons. 1893. Pp. xlv, 368. Price $4.

Mottelay's translation of Gilbert's famous work on the magnet has been expected for some time by the public. It was in the beginning of 1889 that it was commenced, and it seems fortunate that a translator was found for it able to enter thoroughly into the spirit of his author. The difficulties of translating it are spoken of by the translator in his preface. He has been very successful in giving a spirited aspect to the book, which in less competent hands might have been very differently rendered. It is needless to enlarge upon the position of this work in the history of science, as that is known to all. No corner stone of a branch of science of greater interest than this one can well be found. The style in which the book is produced is unexceptionable, heavy paper and antique faced type being employed.

INFANTRY DRILL REGULATIONS, UNITED STATES ARMY. New York: *Army and Navy Journal*, D. Appleton & Co. 1893. Pp. 353, 44. Price 30 cents.

This edition of the drill regulation for infantry is identical with the copy issued to the army from the army headquarters. An interesting feature of it is the list of trumpet calls and drum and fife signals.

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9. A square-rigged house, recently erected at Allston, Mass. Cost, $2,600. Plans and perspective elevation. Mr. A. W. Pease, architect, Boston, Mass.
10. The Fifth Avenue Theater, New York. View of the main front, showing the terra cotta decorations; also view showing the iron framework, erected by the Riverside Bridge and Iron Co., and a view showing the fireproof arching, erected by the Guastavino Fireproof Construction Co.
11. Sketch of a dining-room fireplace.
12. Miscellaneous contents: An improved woodworking machine, illustrated.—A new edge moulding or shaping machine, illustrated.—The box industry.—Natural gas at Geneva, N. Y.—Plaster of Paris floors.—Inside sliding window blinds and screens, illustrated.—City pavements.—The Alberene laundry tub, illustrated.—The "Murray" phaeton, illustrated.—An elegant bath tub, illustrated.—To thaw out frozen pipes.—Improved plane irons, illustrated.

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Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4902) **J. J. R. says: I have a large** windmill, which in good wind gives me 8 horse power. Is it practicable or even possible for me to light my house and barn electrically from this power? A. You can use your windmill power for driving a dynamo for lighting your house; but it will be necessary to use storage batteries in order to secure a steady current. We shall probably publish at an early date an article on this subject.

(4903) **J. M. B. asks: Is it compulsory** for the patentee of a patent, or the person selling the patent, to have date of patent and name of patentee on the article sold? A. No; it is not compulsory. But if not so marked, if any one should imitate the article, not knowing it was patented, such person would not be held liable for infringement until notified.

(4904) **W. W. P.—You can find the current** given out by your dynamo by dividing the electromotive force by the resistance. There is no trouble with your galvanometer needle. If you wish to measure the current, you should use an amperemeter, or a galvanometer with a single large bar for a conductor instead of a coil.

(4905) **W. H. L., Jr., writes: There was a** mistake made in your reply to (4771) W. H. D., March 25, 1893. This is the correct formula: A ⅛ horse power is equivalent to 93 watts, as stated. Allowing an efficiency of 92 per cent (about) = 100 watts.

$$P \div E = C = 100 \div 500 = \tfrac{1}{5} \text{ ampere.}$$
$$E \div C = R = 500 \div \tfrac{1}{5} = 2{,}500 \text{ ohms.}$$

Proof.

$$C \times R = E = \tfrac{1}{5} \times 2{,}500 = 500 \text{ volts.}$$
$$E \times C = P = 500 \times \tfrac{1}{5} = 100 \text{ watts.}$$

(4906) **E. E. D. says: I have made the** castings and am ready to wind my armature and field magnets for the motor described in SUPPLEMENT No. 600. Everything is to a ¾ scale, that is, I have made the castings, etc., ¾ the size of the original. Please let me know what size wire to use on the magnets and armature respectively, and how many coils on each. Also let me know how many volts the machine, ¾ size, will stand and how many it will take to run it, and how many revolutions. A. If you reduce the size of the wire to ¾ of that given in the article referred to, you will be approximately correct, but a machine of a new size requires not only a great deal of calculation but some experiment to secure the best proportions.

(4907) **W. H. S.—The wire will change** 0·014 of an inch per rod for each 10° Fah., or 1·4 inches for 100 rods. Its elasticity will keep it from breaking, if not overstretched.

(4908) **W. B. says: 1. Could you tell me** the power of a water wheel, the diameter of the wheel being 9 inches and of the bucket type, the jet being three-sixteenths inch, and the water pressure being 35 pounds to the square inch? Would the wheel have to be any larger to drive the small hand power dynamo in SUPPLEMENT 161? A. The water wheel, if of the Pelton type, will give you about one-twelfth of a horse power, and should make 900 revolutions per minute. If you make the jet of good form for velocity and one-fourth inch diameter, it will give the same wheel at the same speed about one-eighth of a horse power, and will drive dynamo illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161. 2. Could I not use a piece of very soft rod iron instead of sheet iron for the drum armature? A. Any soft iron is good for the armature. 3. Will common soldering acid solder platinum or not, and what acid will? Platinum cannot be soldered like other metals. The parts to be soldered must be made clean and a thin electro deposit of copper made upon the surface, when it can be soldered with tin and the ordinary tinner's acid.

(4909) **S. W. L. writes: I inclose a sam**ple of a deposit which formed around the sides of a water barrel during a light rain on night of March 13th. Very heavy, threatening clouds formed about 8 P. M., accompanied by some lightning and thunder, but the rain that fell was very light. This deposit, which looks like sulphur, could be seen everywhere the next morning. Can you tell me what it is and what caused it? A. The phenomenon of showers of sulphur, which has been many times described as falling with rain or during great storms and found floating on water and covering the grass and roofs of buildings, while yellow and sulphurous in appearance, is not sulphur. Accurate researches have proved that this dust is nothing else than the pollen of certain flowers, and of pines in particular, which are swept off by the wind and precipitated by the rain, the nature of the pollen depending upon the vegetation that is flowering in the direction from which the wind blows. In Europe, in March and April, the pollen is supposed to be that of alders and filberts. In May and June, that of pines, elders, and birch. In July, August, and September, that of lycopodium, typha, and equisetum. The dust from sand storms is readily recognized by its gritty feel.

(4910) **A. T. B. asks the best mode of** mixing and using Portland and Louisville cement, both in dry and wet places, foundations, and floors; the kind of sand and the proportions. Also the best thing to clean and brighten copper. A. Portland cement 1 part, sand 2 parts, broken stone 3 parts, for concrete foundations. For mortar, the same without the broken stone. For floors, first coat as above for mortar, finish with equal parts Portland and sand. Use for all clean, sharp sand. With Louisville and other American cements, 50 per cent more cement than the above. All cements should be mixed with the sand dry, then wet, stir, and use at once. Oxalic acid in water is much used for cleaning and brightening copper.

(4911) **F. C. F. says: I am having a hull** built for a steam launch, 28 feet long, 5 feet 6 inches beam, depth amidships 29 inches. Will you kindly advise me through your paper the size boiler (horse power), also engine (horse power), to get the greatest possible speed? Also size wheel and number of blades. I would like to get 9 or 10 miles per hour. I also admire an oil, coal, and wood combination. Has that an advantage over steam or oil alone? I would like it as automatic as possible. A. You will require 10 indicated horse power in your engine; cylinder, 5 inches diameter, 7 inches stroke; boiler, 30 inches diameter, 48 inches high, tubular; screw 30 inches, 5 feet pitch, three blades. Hard coal fire for the power you require will give the most satisfactory result. Address advertisers in this journal for details of boat and engine.

(4912) **C. H. R. asks: What proportion** of silver is held in solution (estimated) by the water of the ocean per ton? What proportion of gold? Has there ever been an experiment on an extensive scale to recover the precious metals from salt water? A. In the SCIENTIFIC AMERICAN of June 18, 1892, you will find an excellent article on this subject. It is calculated that there are 10,000 million tons of silver in the ocean.

(4913) **C. P. McC. asks: 1. Why are the** carbons of arc lamps plated with copper? A. It makes them better conductors. 2. What is the salt used or substance in nickel electroplating? A. Nickel sulphate, or a double sulphate of nickel and an alkaline metal. Various formulas are given in our SUPPLEMENT, Nos. 210, 310, 436, 755, and 848. 3. Can a person practically run the small motor in SUPPLEMENT 641 with a storage battery? If so, how large a one? A. Yes. Two cells will run the motor. 4. Of what substance is the carbon in the Edison incandescent lamp made? A. Bamboo fiber carbonized. 5. Where may I find information in regard to the explosion of the idea of two kinds of electricity? A. The idea can hardly yet be considered exploded. See Lodge's "Modern Views of Electricity."

(4914) **H. L. asks: How will I be able to** obtain a black finish on brass tubing that will not scale or knock off? A. Immerse the tube, after being thoroughly cleaned, in a solution of chloride of platinum, which is made by dissolving platinum to saturation, 2 parts hydrochloric to 1 part nitric acid. For other receipts, see "Cyclopedia of Receipts, Notes and Queries," $5, mailed.

(4915) **A. H. W. asks what size magnet** it would take (size of wire, etc.) and how many batteries to secure a lifting pull of one-half pound one-fourth of an inch, also of one pound. A. Make the core of your magnet one-half inch in diameter, with the spools three inches long, and on the spools wind enough No. 20 wire to make the depth of the wire equal to the diameter of the core. Use four cells of plunging bichromate battery.

(4916) **E. L. R. asks: What size pipe** must I use to put in an artesian well that brings water within 75 feet of surface, and put into tank 25 feet above, to put into said tank a stream of water from five to six thousand gallons per hour? Can I use a steam jet pump or had I better use a piston pump? What horse power will it require to do said work? What kind of well boring apparatus is cheapest and best to use in boring said well, say 500 feet, through blue marl, or earth formation like that at Niagara Falls? A. You will have to provide for a lift of about 150 feet; this will be too great for a economy in a steam jet pump. For so large a quantity of water a direct-acting artesian well pump will be the most economical. Such a pump with 10 inch steam cylinder, 6 inch water plunger, 24 inch stroke, making 40 strokes per minute, will do the work. With the friction of the moving parts this will require 8 horse power, with a mean steam pressure of 40 pounds per square inch. The well should be bored 8 inches, which will give room for a 6 inch chamber, although the pipe below the bucket may be 4 or 5 inch. If the well is to be tubed, it should be with 7 inch pipe, which, if casing pipe is used, requires the drill hole to be 8½ inches diameter. Rock drilling through limestone and sandstone is quickest done with a diamond drill. The earthy covering of the rocks should be bored out from the inside of a larger tube than is used for the rock work, the large tube being driven down as the boring proceeds. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 156, 157, 158, 159, and 160, for illustrated description of drilling artesian wells, tools, cost, etc., 10 cents each mailed.

(4917) **W. W. writes: I want to get at** the amount of heat necessary to disintegrate the various gases or odors, and the various plans tried by others. I can handle acid gases, but oily odors are ahead of me so far. A. The odor of oils and animal matter was neutralized in the fat rendering establishments around New York, a few years since, by conducting the odorous gases and vapors under the fire grates. We have no literature on this subject.

(4918) **C. D. B. says: I am putting on** top of a framework 40 feet high a 35 bbl. tub or water tank, insert a 1½ inch gas pipe perpendicularly in bottom of tank down 2 feet below surface of ground (or 42 feet), then at right angles a 1½ inch pipe from standpipe 300 feet on a level, then turn up 2 feet and discharge the water in open air, how high will it throw the water with fountain head kept full depth of tank, 8 feet? A. The height of a jet from your tank will vary very much with the size of the nozzle. If the water level is 48 feet above a half inch nozzle of good form, your jet may be thrown 38 feet high. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, on "The Height of Jets and Fire Nozzles."

(4919) **H. M. asks: In case some**thing gets under the check, will the engineer have to draw his fire? A. It is not necessary to draw the fire when the check does not shut after pumping. There should always be a valve between the check and the boiler, which can be closed when the pump stops, or you can keep the pump running slowly. In such emergencies it only requires a little attention to keep the plant running until the proper time for examination of the check valve. It is a very common and proper practice to close the valve between the check and the boiler and clean out the check valve while under full steam head.

(4920) **R. M. W. asks: Will you kindly** inform me how to find the proper amount of direct radiation to heat a room by steam or hot water? A. The ordinary practice for your climate is one square foot of steam-heated surface to 125 cubic feet of space in room, and one square foot to 100 cubic feet space for hot water. The quantities are derived from deductions and experience. They have been fixed mathematically for different conditions and exposure of buildings and the amount of glass. See Baldwin's work on "Steam Heating," $2.50 mailed, and his work on "Hot Water Heating," $4 mailed.

(4921) **W. B. M. asks for the name of** the best known filling for lining for small ice box, say capacity of two to three hundred pounds. I have one built of hard oak plowed and grooved, double solid bottom and lid, with two inch space around front, back and sides, latter space filled with pounded charcoal, but fail to get satisfactory results. A. Dry asbestos fiber and mineral wool are the only materials suitable for insulating ice boxes, other than charcoal. They should be lightly packed so as to prevent air circulation, as the air alone is the best non-conductor of heat when confined in small spaces by fibrous material.

(4922) **C. F. B. writes: I wish to know** the size smokestack for steamer that has two boilers, 103 tubes in each, 14 feet by 2½ inches; the draught goes through the tubes and about half way back under the boilers into stack between boilers. The present stack is 30 feet high, 36 inches diameter, but draught is not as good as desired. Can you tell me what change to make? A. Your chimney is not high enough. By adding 10 feet to the height you will gain 30 per cent stronger draught. Then, by giving the cleaning of the tubes proper attention, you will obtain full duty from the boilers.

(4923) **A. E. A. asks: What is the low**est temperature that has ever been artificially produced? Also by whom it was observed and by what process it was obtained. Please mention that temperature according to Fahrenheit's scale and also what it is by the Centigrade thermometer. A. The lowest artificial temperature is —140° C., —220° Fah., with bisulphide of carbon and liquid nitrous acid by evaporation. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 449 and 489, on the liquefaction of gases and low temperatures.

(4924) **W. A. P. writes: I am using a** tubular boiler and feed with an inspirator; the connection for supplying the boiler with water is on top at the front end, the supply pipe running down between the tubes. The blow-off pipe is at the back end of boiler near the bottom. Now I want to connect another inspirator to boiler. Would there be any objection to connecting water supply in blow off pipe? Of course would connect in such a manner as not to interfere with blow-off. A. There is no objection to feeding the boiler through the blow-off pipe, if the feed pipe has a valve and check valve properly arranged, whether the blow-off pipe is at the front or rear end of the boiler. Feeding through the blow-off pipe is in common practice.

(4925) **B. A. C. writes: A few days ago** I was assisting an organ tuner, by sounding different notes and chords for him. In our conversation he told me that it was necessary to have the temperature 65° before the organ could be tuned. Why is this? A. As the different materials of which the organ is constructed have different coefficients of expansion, it is obvious that at any other temperature than that at which the organ is tuned, some of the pipes will be slightly out of tune. For this reason the tuning is done at a temperature of 65°, which is about the average temperature of churches or places where organs are used.

(4926) **A. R. writes: I want to pump** water from a tube 10 feet high through a half inch pipe. What kind of a pump will require the smallest power to do the work? Will a pump which draws the water from the top take less power than one pressing the water from the lower end of the pipe? A. Any hand force pump will answer your purpose. It takes no more power to force than to lift the water.

(4927) **W. McV. asks: What kind of** cement will stick on a stone wall over whitewash, to prevent the water from coming through? The above refers to the foundation of a flour mill. The river rises in the spring and leaks through the walls of basement, causing considerable annoyance. It is well plastered now, but water seems to leak through and requires the services of a fire engine to keep it pumped out. A. It will be difficult to make such a basement as you describe water tight. It might perhaps be done by carefully pointing the walls with best quality Portland cement, and laying a three inch Portland cement pavement.

(4928) **J. F. R. asks the amount of** shrinkage that should be allowed for, in making patterns for the eight light dynamo. A. For iron allow ⅛ inch to a foot. For brass 3-16 inch to a foot.

(4929) **J. W. H.—For dye vats as you** describe, set the glazed bricks as close as possible in a putty made of glycerine and litharge. Mix in small quantities and use at once.

(4930) **J. S. asks: What sized propeller** would be required to run a 13 foot boat, if the engine is ¼ H. P.? How many miles per hour could the above boat go? A. Your boat will require 10 inch propeller, and may make 4 miles per hour.

(4931) **W. R. writes: I am making a** small box of aluminum and would like to solder the corners together. Now I ask you, Is there any solder that will hold? If so, where shall I be able to get it? Also, can aluminum be welded or fastened together by heat? If so, what way? A. You can make a solder of tin 3 parts, zinc 2 parts, cadmium 5 parts, to solder with a soldering copper, using paraffine as a flux. Aluminum cannot be welded as you suggest.

(4932) **E. E. P. T. asks for a rule for de**termining the requisite thickness of iron in engine cylinders for different horse powers; average steam pressure, 100 pounds. A. The cube root of the diameter in inches × 0·36 for the thickness of the iron in inches is a good rule, subject to small variations for special service.

(4933) **G. E. S. asks how to gild the** edges of books. A. White of egg, well beaten up, is the ordinary sticking material used by binders to put the gold leaf on. The leather back of the book is varnished with it, and when dry, a strip of gold leaf is put on the place where the letters or ornaments are to be placed; the letters used are common printing types (they must be new, however, and not been used with printing ink). They are heated a little above the boiling point of water, which is easily tried with a wet finger, and then they are pressed on the gold leaf for a few seconds only, when the heating of the albumen or white of egg under it fixes them to the leather of the book. The ornamental figures used are commonly made of brass and manufactured for the use of bookbinders, while the type is screwed in an appropriate brass or iron holder, with wooden handle. The back of a well bound book being always round, the proper way of putting on the gilded letters and ornaments requires a certain way of manipulation, which it is best to acquire by visiting some good bookbinder's shop in the next large city to see the operation and use your eyes properly so as to get all little details. The sides of books being flat, it is best to put the letters and ornaments under a press. The type is put up in a proper form, it is heated, put under the press with the varnished side of the book, covered with gold leaf on the right place, and the press screwed down. Sometimes the binder puts the strip of gold leaf on the face of the type, in place of on the book. This is equally good, and under certain circumstances preferable. From the "Scientific American Cyclopedia of Receipts, Notes and Queries."

(4934) **S. C. S. writes: We are pumping** waste sulphuric acid a distance of 1,400 feet, with a rise of about 35 feet, and are experiencing a great deal of trouble with the pumps used, and would like to have some suggestions from you in regard to the matter. The pumps we have been using are built especially for us of so-called acid metal, probably a composition of copper and lead, by reliable manufacturers; but after two or three weeks' service they commence to churn, the water end being so much eaten. We have been pumping about 2,000 gallons per hour, and our line is 2 inch lead pipe, while the capacity of the pump is said to be 5,000 gallons per hour. There may be some dirt in the liquid pumped. What remedy would you suggest to have our pumps hold

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out, or could you suggest any other method of transferring the liquid? A. The most satisfactory method of pumping acids is by means of compressed air, for which you will need an air compressor equal to 20 cubic feet free air per minute. One of the smallest sizes made by the Ingersoll-Sergeant Drill Company will be large enough. Draw the acid into closed tanks suitable for 50 pounds pressure per square inch, although you may not need a higher air pressure than 30 pounds per square inch. Attach air pipes to top of tanks and the exit pipe at the bottom. You will need no extra valves other than the draw cock from the acid vat and a cock to let out the air when the acid is discharged into the tanks.

(4935) F. T. B. asks: Which side of a leather belt should be run next the pulley? Why? Should this hold true under all conditions? A. For best efficiency the hair side should run on the pulley; but appearance and custom has made the flesh side on the pulley the almost universal practice. The soft surface of the hair side gives a belt a closer and more perfect contact with the pulley, which increases its pull or decreases the tension necessary for the same pull with the flesh side next the pulley.

(4936) M. F. asks: Which of the two is the superior incandescent lamp, one with carbon filament or one with platinum filament, both being of good manufacture? A. We believe it is pretty well settled that platinum incandescent lamps are of no practical value.

(4937) W. B. F.—You can make your aluminum solder by melting together 3 parts tin, 2 parts zinc, 5 parts cadmium; or 9 parts tin, 1 part bismuth. Use paraffine, stearin, or copaiva balsam as a flux. Use a soldering copper to coat the surfaces to be soldered.

(4938) J. M.—You will find batteries described in SUPPLEMENTS 157, 158, 159, and 793; but we would advise you to purchase a battery for your purpose rather than to try to make one. For ringing bells on an open circuit, we recommend the Leclanche battery.

(4939) J. C. F.—You could not successfully reduce the voltage for electroplating by means of a resistance box.

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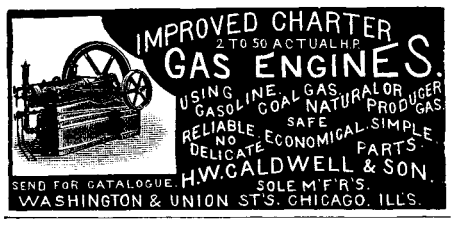
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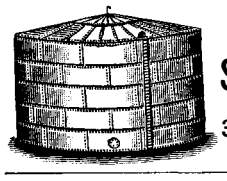

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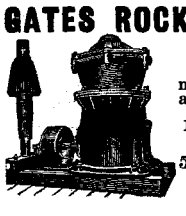

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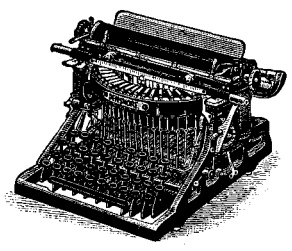

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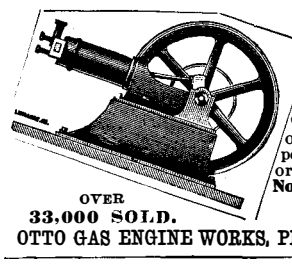

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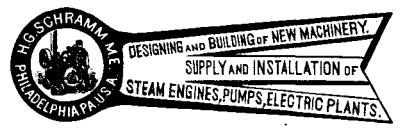
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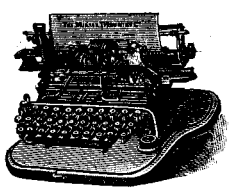

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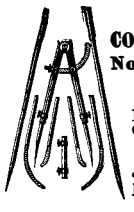

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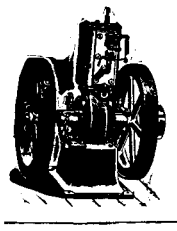

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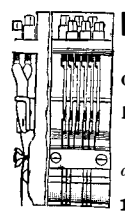

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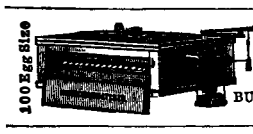

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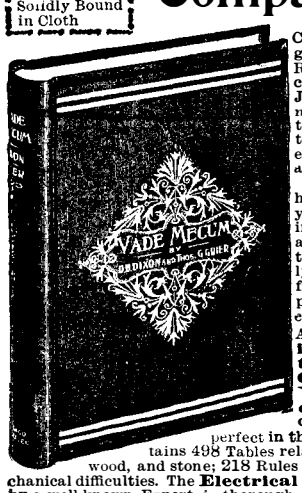

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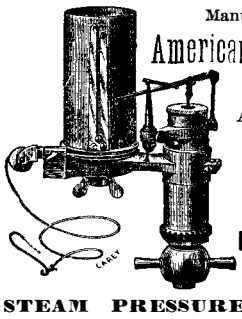

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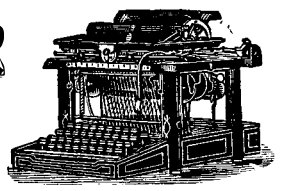

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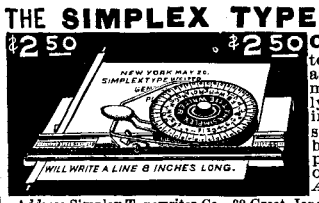

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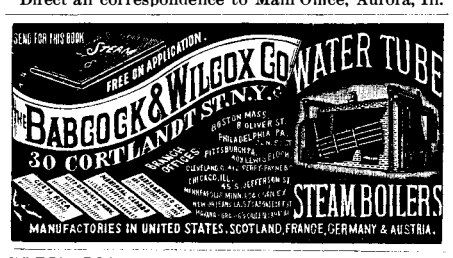

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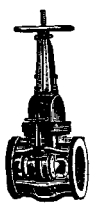

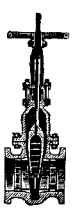

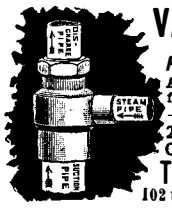

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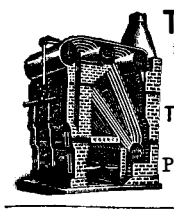

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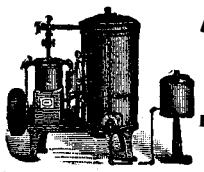

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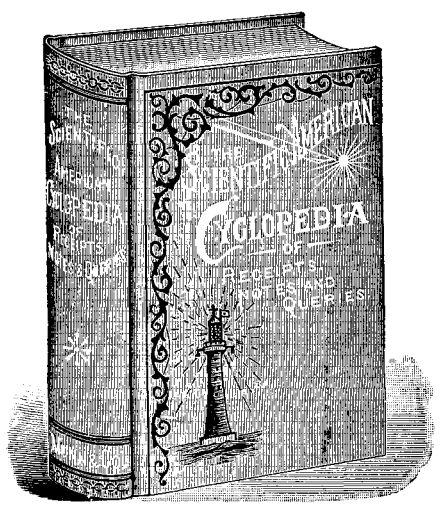

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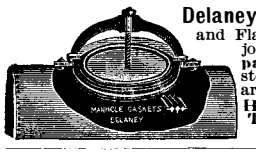

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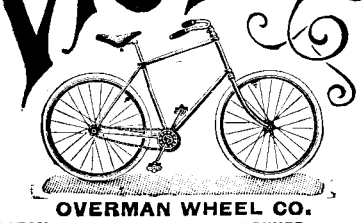

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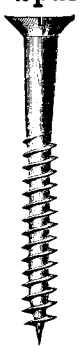

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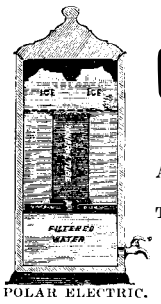

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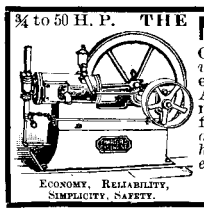

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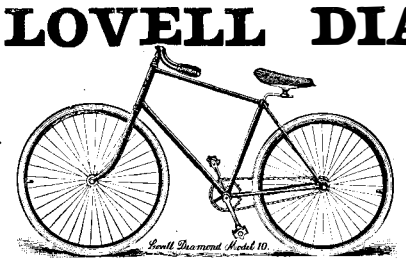

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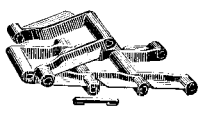

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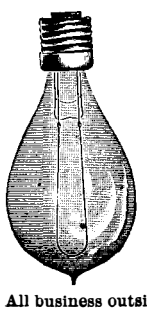

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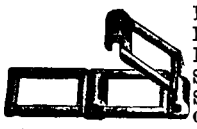

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